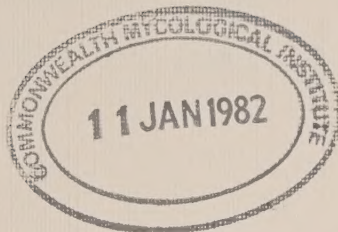


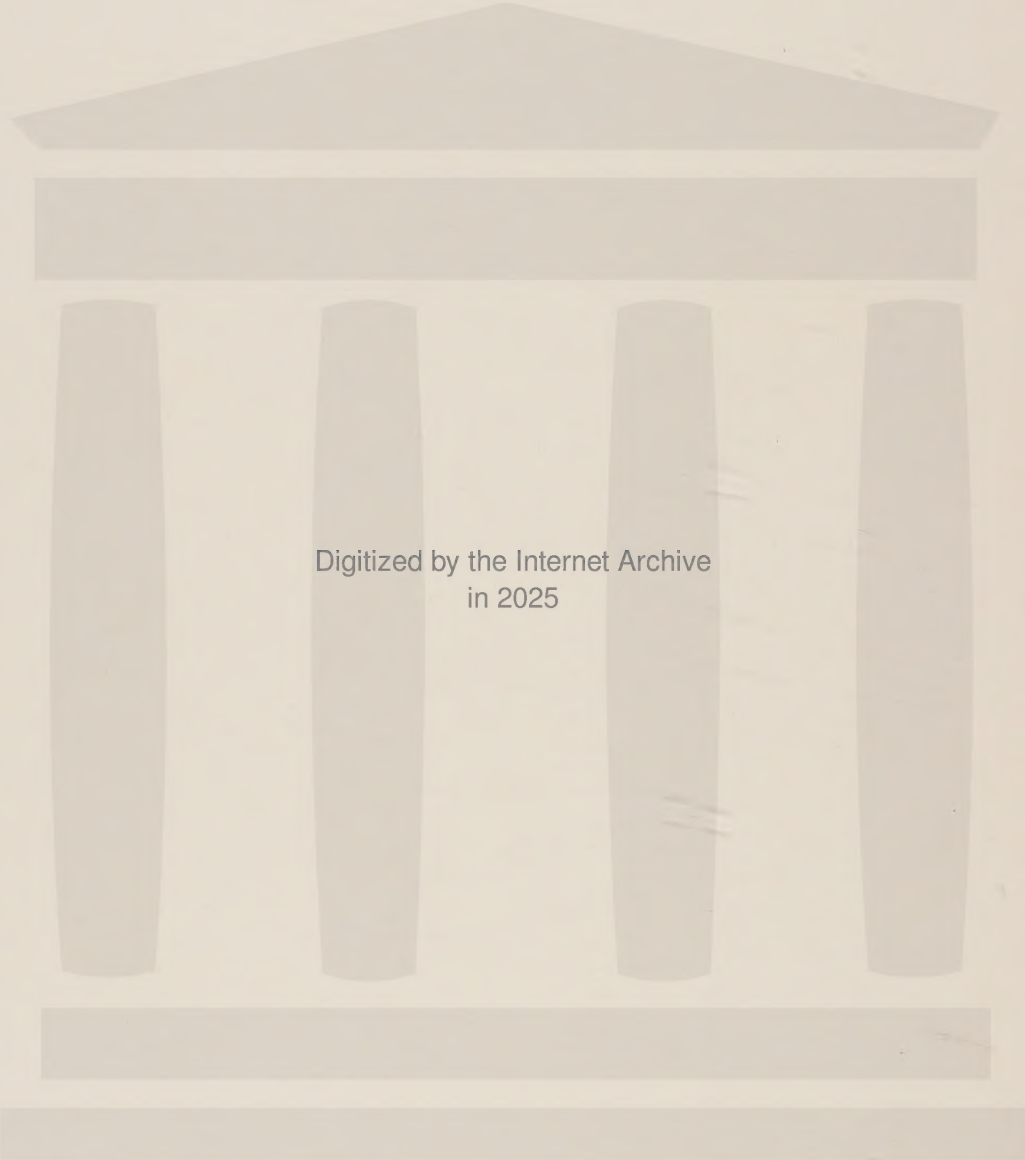
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DEPARTMENT OF AGRICULTURAL TECHNICAL SERVICES

ANNUAL REPORT



1 JULY 1979
to
31 MARCH 1980



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ANNUAL REPORT

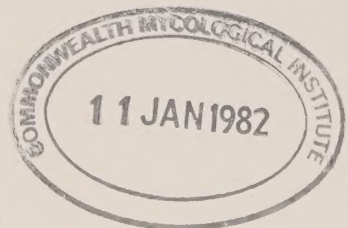
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**Secretary for
Agricultural Technical Services
for the period
1 July 1979 to 31 March 1980**

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**Report of the Secretary for Agricultural
Technical Services for the period
1 July 1979 to 31 March 1980**

THE HONOURABLE THE MINISTER OF AGRICULTURE,
PRETORIA

SIR,

I have the honour to submit herewith the Annual Report of the Department.

Secretary for Agricultural Technical Services

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I. Introduction

The Department of Agricultural Technical Services is one of the two separate departments of agriculture into which the former Department of Agriculture, which had existed since Union in 1910, was divided on 23 October 1958. On the one hand the coming of age of the Department of Agricultural Technical Services on 23 October 1979 affords an opportunity for reflection on its activities and achievements during the past 21 years. At the same time, however, an event such as the rationalisation of the Public Service in the course of which this Department was combined on 1 April 1980 with the other two departments of agriculture and the Sea Fisheries Institute of the former Department of Industries is an invitation to look into the future.

This last report of the Department of Agricultural Technical Services therefore affords the opportunity, in addition to giving an account of events during the last year of existence of the Department in its present form, briefly to review a few important events and achievements during the 21 years of existence of the Department of Agricultural Technical Services, and to sketch the challenges with which the new dispensation may have to deal.

Notwithstanding extremely variable and occasionally relatively unfavourable natural conditions, the agricultural industry in South Africa has flourished during the past 21 years. The volume of agronomic, animal and horticultural production has increased considerably and record production figures have frequently been achieved in respect of certain products in recent years.

This achievement is largely due to the support afforded to agricultural production by timeous research, agricultural technical supporting services and the dissemination of new knowledge, and to the fact that producers have been persuaded to apply new knowledge and techniques.

The following are a number of the Department's major achievements during the past 21 years in carrying out its task of promoting systematic agricultural development on a national basis:

RESOURCES

Land - By the early sixties it had become clear that a basic knowledge of all the soils in the Republic was essential. The Soil and Irrigation Research Institute was therefore established; in addition to research on soils the Institute also undertakes research on irrigation, irrigation planning and agricultural meteorology. By last year this Institute had mapped almost two-thirds of the area of South Africa on land type maps (soil,

climate, terrain) to a scale of 1:250 000.

In 1977 the first system for the classification and naming of the soils of South Africa was published.

Approximately 5,9 million ha of land was investigated for irrigation development and 346 000 ha was studied on an intensive scale.

Since 1977 the Soil and Irrigation Research Institute has provided an analytical service for agricultural bodies with the aid of highly sophisticated analytical equipment which now performs 100 000 individual determinations on 15 000 samples annually. Since 1974, 301 000 ha of land in 21 development areas of the Highveld Region has been classified on a scale of 1:20 000.

A further achievement has been the drawing up of a soil map of this region, scaled to farm size, with the aid of LANDSAT satellite photographs. As far as is known it is the first of its kind in the world. This process will speed up soil classification immeasurably.

In the Transvaal Region 349 454 ha of land within target areas was mapped to a scale of 1:20 000. This forms the basis for extension programmes and run-off control planning, which are being very successfully completed.

Veld and pastures - The Botanical Research Institute, which is primarily responsible for the identification of the varied plant life of South Africa and the provision of herbarium services, has made a unique contribution in this respect.

The National Herbarium in Pretoria, which contains 800 000 specimens, has not only developed into the biggest of its kind in Africa, but is also the largest computerised herbarium in the world.

Almost 32 500 plants specimens are identified annually by the Institute.

After many years of research, controlled selective grazing has been developed at the Soutpan Experimental Farm. This grazing concept (the Soutpan system) has found wide acceptance and has led to an increase in the calving percentage from 56 % to 86 % and an increase in the 205 day weaning mass from 144 kg to 192 kg, as well as to an extension of the summer grazing period in the high-rainfall, sourveld pastures.

Research on the chemical control of invader bush has led to the registration of suitable herbicides and to a decrease in the spraying volume from 40 l/ha to 20 l/ha, with consequent major savings for farmers.

In the Eastern Cape it has been established that where goats and cattle graze together in the scrub forest, red meat production can be boosted by up to 50 % per ha.

With regard to veld weeds, one of the most serious problems at present is nassella tussock, which has already invaded almost 50 000 ha of

valuable veld in the Karoo and Eastern Cape. Since 1978 the Department has been controlling this weed and it is calculated that about 75 % of the infestation is already under control.

Full-time attention is being given to radical veld improvement and the development of artificial pastures. Research in the Transvaal Bushveld indicates that where about 20 % of the veld is replaced by the indigenous pasture grass *Cenchrus ciliaris*, the carrying capacity of a farm unit can be virtually doubled. Midmar ryegrass, which has a very high yield potential and is resistant to leaf rust, and a new rough cocksfoot, Karkloof, which produces a 25 % higher yield than cultivars of European origin, were developed in Natal.

A new lucerne cultivar which is resistant to bacterial wilt was developed.

During the past two decades certain institutes and divisions, doing both basic research and applied research to assist particular industries, were founded; the task of these bodies is to carry out specialised research and provide auxiliary services. The following are a few of the important contributions these institutions have made to agronomy, horticulture and animal husbandry:

Over a period of years the Division of Plant and Seed Control has secured South Africa's full participation, since 1964, in the OECD's international Herbage and Oilseeds Scheme. Thousands of tons of lupin seed have been exported to Europe under this scheme.

It is also due to the efforts of the Division that the EEC has granted equivalence, since 1971, to South African seed certification in respect of a large number of crop types. Consequently South African seed can be exported to EEC countries on an equal footing.

Furthermore, in 1977 the Republic was accepted as the tenth member country of the Union for the Protection of New Plant Varieties and was appointed in 1978 as the international registering authority for certain species of protea.

Similarly the Plant Protection Research Institute makes major contributions to the promotion of agronomic and horticultural production, *inter alia* through basic research on integrated disease control, where great success has been achieved with pests of citrus, potatoes, sorghum and cotton.

As a result of the Institute's in-depth research on biological nitrogen fixing, South Africa is regarded as one of the leaders in this field.

AGRONOMY

Research on summer cereals has been centralised since the establishment, in 1976, of the Summer Grain Centre.

The release of high-lysine hybrid maize was a remarkable breakthrough and holds major advantages for the enrichment of human and animal feed. The breeding of drought-resistance into maize and the very promising results obtained

with this work at Oudtshoorn will be of great benefit to the maize industry.

The Small Grain Centre was founded in 1976 to direct and co-ordinate research on small grain on a national level:

A comprehensive breeding programme comprising over 700 crossings is being undertaken and several new wheat cultivars and durum wheat cultivars have already been released.

Major success has also been attained with the identification and control of several diseases and pests of small grain.

The Tobacco Research Institute is still making an enormous contribution to the stimulation of this important industry.

In 1964 the Institute released white rust resistant flue-cured, air-cured and Burley tobacco cultivars, and in 1968 there were further releases, namely of cultivars with resistance to tobacco mosaic virus (TMV) and white rust.

In 1975 the breeding of tobacco cultivars with resistance to TMV, white rust and black shank followed and in 1979 the Institute succeeded in transferring black root rot resistance to strains already resistant to the above diseases.

Other achievements of the Institute during the past two decades have included the successful transmission of resistance to stubby root nematodes through back-crossing, the determination of norms for the principal nutrients in soils, the use of soil analysis results for fertilising recommendations, the drawing up, in co-operation with manufacturers of pesticides, of effective and safe control programmes for various diseases and pests of tobacco and the development of suitable curing schedules for the bulk curing of tobacco.

HORTICULTURE

The sophisticated soil and leaf analysis services of the Citrus and Subtropical Fruit Research Institute were put at the disposal of producers, which resulted in major savings for them.

Intensive research inputs with regard to integrated biological control led to major breakthroughs in the control of citrus pests.

The greening problem in citrus was solved by research: where losses were formerly as high as 40 % for a crop year, they were reduced to as little as 2 % and this dreaded disease no longer poses the threat it did formerly.

As a result of the Institute's research on black spot and fruit fly, it is now possible to export 75 % of the Republic's citrus crop. The Institute's work on cold storage, packing materials, irradiation, post-harvest spoilage, ripeness determinations and the development of sophisticated measuring instruments has meant that subtropical fruit can be very successfully exported by sea today. A few years ago this was not possible.

Microjet irrigation is a South African concept which was extensively developed by the Citrus and

Subtropical Fruit Research Institute and taken over unchanged by the USA, Australia and Israel.

After about 20 years of methodical breeding and cultivation, the "perfect" pineapple, which has a cylindrical shape, has been developed. This achievement is of great value to the canning industry.

The Fruit and Fruit Technology Research Institute and the Horticultural Research Institute are responsible for the deciduous fruit industry in the winter rainfall and summer rainfall areas respectively.

Since 1959, 22 new fruit cultivars have been bred and released by the FFTRI, including several new plum cultivars such as *Songold*, *Harry Pickstone*, *Reubennel* and *Redgold*, which have infused new life into the ailing plum industry.

The five new canning peaches - *Walgant*, *Oom Sarel*, *Prof. Black*, *Prof. Malherbe* and *Prof. Neethling* - have extended the canning season by six weeks, which makes more economic utilisation of labour and canning facilities possible.

The two apricot cultivars *Peeka* and *Piet Cillie* have already won a place in the industry owing to their improved production and fruit quality and the recently released *Palsteyn* appears to have good prospects.

The release of South Africa's first table grape cultivar suitable for export, namely *Bien Donn *, is of great importance to the table grape industry.

Since 1959 four strawberry cultivars, namely *Festival*, *Klaradyn*, *Parfaite* and *Tiobelle*, have been bred and released. Today 70 % of all strawberry plantings in the Western Cape consist of *Tiobelle*.

Furthermore, satisfactory control measures against the majority of the 25 serious diseases of deciduous fruit have been developed and since the early sixties research on soil management practices, planting systems, planting material, pruning practices and orchard management have led to an average increase in the apple crop from 20 tons/ha in the fifties to maximum productions of about 120 tons/ha at present.

Largely through the efforts of the Horticultural Research Institute, the table grape industry in the summer rainfall area has developed from a risky undertaking to an industry which now supplies more than half the local delivery to the Johannesburg market.

Seven table grape cultivars with resistance to berry cracking were bred and released by this Institute during the past 15 years and the peach industry in the summer rainfall area was placed on a sound footing by the breeding and release of nine new cultivars that ripen at such times that a long production season is now possible.

The progressive approach of the Oenological and Viticultural Research Institute to the importation and evaluation of new and existing wine grape cultivars, especially during the past 10 to 15 years, has led to a very favourable swing to quality cultivars in most of the wine farming areas.

During the past 10 years, 13 new scion cultivars have been released to the industry and clones of the most important commercial scion and rootstock cultivars have already been released and are being multiplied. Improvements of up to 100 % in the yield are expected from this material.

The establishment of the South African wines of origin system has given South African wines increased status both locally and abroad.

ANIMAL PRODUCTION

The Animal and Dairy Science Research Institute is responsible for basic livestock production research within the Department, for all poultry and dairy technology work and for the livestock improvement schemes (performance testing).

The Dairy Cattle Performance and Progeny Testing Scheme was developed from the old Milk Recording Scheme and has grown to such an extent that 60 000 cows (56 per cent of the registered dairy cows) now participate in the scheme. The progeny testing section was launched in 1976 and the first semen of approved bulls will be available shortly.

The first growth testing centre for beef breed bulls with a capacity of 90) for the Beef Cattle Performance and Progeny Testing Scheme was commissioned in 1963. Following the initiation of growth tests for young stud bulls its capacity expanded to the present level of 1 520 bulls a year, which makes it the biggest individual testing component of its kind in the world.

A similar performance testing scheme for pigs was expanded over the years to reach a capacity of 1 564 boars in 1979 at Irene, Elsenburg and Cedara. Major progress has been made in the fields of genetics and feed conversion.

In 1978 the National Fleece Testing Scheme started refining certain techniques; field data are now processed by the central computer in Pretoria, and the Scheme is also the most comprehensive of its kind in the world.

The well-known Random Sampling Egg Laying and Broiler Test at Glen was supplemented in 1970 by a unit at Irene. The latter is now the biggest poultry testing unit in Africa where both meat and egg production evaluations are carried out.

Long-term investigations of and survey studies on the composition of milk, the yield values of various dairy products and hygienic matters have made it practicable to purchase milk on the basis of fat, protein and bacterial content.

The production of ultra-high temperature treated milk (milk with a long shelf life) has been investigated and the successful production of this type of milk under South African conditions has been made possible. This milk has an excellent keeping quality, which may be regarded as the *biggest breakthrough in modern dairy technology*, and which makes it possible to supply milk to

remote areas, where modern milk processing techniques do not exist.

An important breakthrough by the Institute in the field of stock feeding has been the discovery of chemical methods of treatment to increase the nutritional value of low-grade roughage and waste products. This makes it possible to reduce the amount of maize required for stock feeding.

Important progress in preventing cold shortening of beef carcasses has been made by means of electrical stimulation. This increases the tenderness of meat.

After South African protein sources had been evaluated, considerable success was achieved in finding replacements for fishmeal, which has become increasingly scarce, in animal production.

ANIMAL HEALTH

The Veterinary Research Institute has long been internationally acclaimed for its pioneering work on animal diseases and related problems. Its major achievements of the past two decades include the following:

Lumpy skin disease occurs in several African states as well as in this country and several researchers elsewhere had made vain attempts to isolate the virus. The Institute's virus section was the first to isolate the virus and grow it in tissue culture, after which an effective vaccine against the disease was developed.

Onderstepoort also played a leading part in the control of Rift Valley fever and was the first to develop a live vaccine against the disease, which was followed by an inactivated product.

Its vaccine against elephant skin disease is one of the only two safe vaccines against protozoal diseases *in the world*.

Onderstepoort is internationally recognised as a centre of specialised knowledge of bluetongue and serves as a referral centre for the typing of bluetongue virus races.

The riddle of the cause of exophthalmos has been solved by carrying out very exact post mortem examinations on natural cases of exophthalmos. It was possible to establish through extremely close observation that the larval stages of a type of fly called *Gedoelestia* are responsible for this condition.

Considerable progress has been made with an investigation of the cause of jaagsiekte, a fatal form of lung cancer, using the sophisticated techniques of molecular biology.

An interesting breakthrough has been made in connection with the control of black flies *Simulium* spp., which have occurred in pest numbers along the Vaal and Orange Rivers during the past few years. Pesticides were found to provide temporary relief, but create other problems. A method which produces excellent results was then developed, namely the manipulation of the water level in the river. By this method the immobile pupal stage is exposed to dehydration.

The cause of parafilariosis, or false bruising, in cattle was unknown until the sixties, when

Onderstepoort established that the disease is caused by *Parafilaria*, a type of worm. A preparation was developed that kills the worms inside the cattle and protects the cattle against infestation for a few months longer.

Diseases such as rinderpest, bovine pleuropneumonia, European swine fever, glanders, nagana and East Coast fever caused severe losses during the earlier decades of this century, but the Division of Veterinary Services is able to control these diseases successfully by means of strict quarantine measures, slaughtering and the control of carriers.

Foot-and-mouth disease, African swine fever, sheep scab, bovine tuberculosis and bovine brucellosis are the most important diseases at present being controlled by various measures taken by the Division. Considerable success has been achieved in all cases.

RESOURCE CONSERVATION

During the fifties the Regional organisations started a methodical campaign to make the farming community aware of the necessity for conserving soil, veld and water resources and the planning of individual farms was started from scratch. The Extension Service of the regional organisations made an enormous contribution during the past two decades to the stabilisation of the farming industry in general and the conservation of agricultural resources in particular.

A few of the outstanding achievements of the Extension Service in recent years are that about 85 per cent of all farms in the Eastern Cape Region have now been planned, that 20 848 km of contour banks have been surveyed in the Natal Region, which represent about 33 % of all lands owned by Whites, and that 32 600 km of contour banks, protecting about 115 000 ha of land, have been built in the Winter Rainfall Region since 1959.

The numerous key soil conservation works built by the Division of Agricultural Engineering in all the most important of the upper reaches of the Orange River have laid the foundation for the stabilisation of both eroded and vulnerable areas. The pioneering research work done on donga reclamation has placed South Africa among the world leaders in this field.

VELD CONSERVATION SCHEMES

The Department supplemented farm planning and campaigns such as the Grass Ley Crop Scheme with a Veld Reclamation Scheme, which was launched in 1966. This scheme was necessitated by the devastating drought which occurred in the northern and north-western parts of the Transvaal and the Cape, from 1961 to 1966.

In terms of this scheme farmers are compensated for the withdrawal of pastures from grazing. Almost R3,3 million was paid out on about 2 600 000 ha, which was withdrawn from grazing.

Notwithstanding a few objections to the scheme from pasture scientists, this campaign led to an enormous change in awareness and in the attitude of farmers towards veld as a resource. Numerous extension programmes and farmers' study groups were the indirect result of this scheme.

The Stock Reduction Scheme was introduced in the sheep pasture areas in 1969. In this case participants were compensated for the livestock they withdrew and almost R45 million was paid to 6 572 participants from 1969 to 1978.

MECHANISATION

In the field of mechanisation planning, the Division of Agricultural Engineering is providing an extremely valuable service:

After thorough tests on agricultural implement and equipment have been carried out, scientific instructions on the optimum use and improvement of agricultural implements are given to farmers and manufacturers of implements.

A sophisticated testing centre for tractor performance - the only one in the world that carries out tests at 1 500 m above sea level - has already produced results of inestimable value. The pioneering work done at this testing centre on sunflower oil as a supplement for diesel fuel has evoked world-wide interest.

An advisory service to farmers on the mechanical harvesting of crops such as groundnuts, tobacco, cotton, potatoes and dry beans is still making a big contribution to agricultural development.

PROGRAMMED EXTENSION

During the past two decades the study group has been very successfully used by the extension service as a communications medium.

From a modest beginning during the early sixties, the number of study groups of the Departmental extension service grew to 258 in 1979, with a combined membership of 2 774 farmers. In all 54 of these study groups, with a membership of 802, were founded exclusively to deal with matters related to field husbandry.

In numerous cases the activities of these study groups have made an enormous contribution, on an extensive scale, to agricultural development and progress with production.

THE DISSEMINATION OF KNOWLEDGE

The explosion of knowledge in the field of agriculture during the post-war years not only led to the establishment of a Departmental information service, but made enormous demands on the service right from the start.

The Division of Agricultural Information is performing an indispensable service in the following respects:

As an extension of the Department's information service, the Division has developed

mass communication channels through which the farmer, the agricultural specialist and the consumer can be reached. This was achieved, *inter alia*, by expanding the Departmental radio service in collaboration with the SABC, by the introduction of a comprehensive publication programme for distributing specific information on particular subjects to identified circles of readers within the farming community, and by means of a newsletter. An audio-visual service was established whose functions include the compiling of diaprogrammes for use by the extension service. Specialisation within the agricultural industry and the enormous volume of agricultural research done has had a very considerable effect on the task of disseminating information. With the purpose of reaching every farmer in the country, the Division has built up a computerised address list that will eventually be converted into a farm file system.

With regard to research information for agricultural researchers, a computerised documentation centre is at present being set up; it will include both national and international agricultural information banks.

PROSPECTS FOR THE FUTURE

When agriculture is at a relatively low level of development, fairly big improvements can be brought about by relatively small technological inputs. This stage is past in the Republic and significant improvements will in future depend on more basic knowledge.

Consequently, increasing demands will be made on agricultural research and technical advice in respect of production. The unused stock of technology and the current rate of provision of new technology are not sufficient to ensure the production of enough food for the increasing population by the end of this century. If agricultural production is to meet the challenge an immediate and urgent search for new supplementary technology to be used by the last half of the present decade will be necessary.

It is clear that the traditional concept of superficial crop research on general and fairly vague lines can no longer meet the demands of agriculture today.

Sustained increases in crop production now require more fundamental and specialised research inputs with regard to the improvement of crop breeding, increased knowledge of plant physiology in connection with more efficient photosynthesis, transpiration and the storage of photosynthates and mineral nutrients, effective moisture utilisation and drought resistance, the control of biological stress factors such as insects and diseases, manipulation of the environment through fertilising and liming, the promotion of biological supplies of plant food, and research on soil conservation and soil compaction. Most of these fields now require a multi-disciplinary approach in order to realise production potential or solve problems.

There are already indications that stock numbers on natural pastures, especially in the drier areas, are still too high. For the immediate future, therefore, any increase in total red meat production may be expected to come chiefly from an intensification of stock production systems. In the long term the natural pastures will make a significant contribution to an increase in red meat production, if the necessary research and extension inputs are provided.

During the past 20 years there has been a considerable change in the relative contributions made by the various livestock industries to total meat production in the country. While the total meat production over this period has doubled, the relative contribution of beef to total meat production during the same period has dropped from 64 % to 52 % and that of mutton and goat's meat from 21 % to 15 %. On the other hand, the relative contribution of the broiler industry has increased from 6 % to about 30 %. Those branches of the livestock industry that lend themselves to vertical expansion can be expected to become increasingly prominent in future.

The research programme on livestock diseases promises to be successful in several respects, and it is hoped that the vaccine factory at Onderstepoort will be able to satisfy the expected rise in the local demand for vaccine. A considerable increase in

vaccine exports is also anticipated. Although success has recently been achieved with the campaigns against foot-and-mouth disease and sheep scab, and good progress is expected with the control of tuberculosis and brucellosis, efforts to combat stock diseases can never be relaxed.

Agricultural resources are limited and vulnerable, and claims on agricultural land are continually being made by other sectors. This serves to underline the importance of vertical production increases, the more efficient use and protection of the natural resources having become necessary.

Some of the fishing waters of the Republic are already showing signs of overexploitation. The reduction in catches and the increasing industrial costs have become a source of great concern to certain sectors of the industry. In certain cases it may become necessary to consider a further reduction in fishing quotas.

Through the application of existing knowledge and through further systematic in-depth research, the Department of Agriculture and Fisheries will continue its efforts to promote optimum agricultural production on the principles of optimum resource utilisation, for the benefit of South Africa.

II. Plant Production Improvement

FIELD HUSBANDRY

SUMMER CEREALS

MAIZE

Streak-resistant pure strains were evaluated in single crossing trials at several localities during the past season. These strains will be released to the private sector and could make a major contribution to the composition of future maize hybrids.

The latent gene that contributes to drought resistance was identified at Oudtshoorn from a tropical Mexican variety. This trait is at present being bred into the most promising local breeding material and should make a major contribution in future to the development of maize hybrids with better resistance to drought.

Commercially viable cultivars were evaluated on a country-wide scale for adaptability. Two cultivars performed exceptionally well.

An ambitious tillage research programme has been launched by the Summer Grain Centre. It has been established that compaction is a very much more serious problem on sandy than on heavy soils.

At Cedara there are no-till maize plots that are seven years old. On the average these plots outyield conventionally produced maize, but because the costs involved in keeping the weeds under control exceed the costs of traditional production methods the system is not recommended.

In the Winterton area scheduled supplementary irrigation increased maize grain yields by 58 %, i.e. from 6,36 to 10,23 tons/ha during the 79/80 season. The total amount of irrigation water supplied was 119 mm.

Plant diseases

Cultivars were evaluated for susceptibility to two important leaf diseases, viz:

Northern leaf blight *Helminthosporium turcicum* - The reaction of 49 cultivars to this disease was determined by artificial methods of infection.

Southern leaf blight *Helminthosporium maydis* - The reaction of 98 cultivars to this disease was determined by an artificial method of infection.

Maize smuts - Cultivars were evaluated in order to determine susceptibility or resistance to boil smut *Ustilago maydis* and head smut *Sphacelotheca reiliana*. The technique for infecting maize artificially with boil smut has been improved to such an extent that some of the private breeders also use this technique.

Diplodia stem rot *Diplodia maydis* - Forty-nine cultivars were evaluated for resistance to *Diplodia* stem rot with the aid of artificial infection techniques.

Insect control

One illuminating finding of the black maize beetle work team, arrived at with the aid of light traps, is that the beetles that cause stand losses during the early part of the growing season are the same insects that are to be seen during the autumn months of the preceding season. The females lay eggs during December and January, so causing later infestations. Experimental work undertaken in co-operation with the private sector led to the identification of several insecticides that appear promising for the control of this pest.

In an attempt to improve the present warning service against maize stem borer infestations, a synthetic sex attractant was developed in co-operation with a private firm, the intention being to use it in traps for the monitoring of moth flights. The latest results on the damage done by this pest indicate that the application of insecticides at a lower level of infestation is economically justified.

GRAIN SORGHUM

Commercially viable cultivars and those submitted for registration were evaluated on a country-wide basis for yielding capacity and other agronomic properties such as standability, threshability, malting quality etc.

BUCKWHEAT

There are a few promising cultivars that may be suitable, after further investigation, for release to producers.

WINTER CEREALS

Breeding research on small grain varieties in order to create well-adapted cultivars for the various national ecological areas is carried out on a national basis by the Small Grain Centre at Bethlehem. Material is therefore being widely planted and evaluated in order to obtain varieties that meet specific requirements. Data collected during the past two years indicate that the genetic variation in respect of yield, especially in irrigation areas, is diminishing all the time. Increasing attention to cultural practices will therefore be required in order to achieve higher yields.

Research on grain technology

(a) The characterisation of wheat cultivars in respect of gliadin band patterns with the aid of gel electrophoresis was started.

(b) *Premature sprouting of wheat* - A total of 85 wheat strains (50 winter wheat, 16 intermediate wheat and 19 spring wheat) were tested for resistance to premature sprouting. Twenty days' resistance to sprouting was taken as the norm and about 40 per cent of the winter strains, 69 per cent of the intermediate strains and only 17 per cent of the spring strains were selected.

(c) *Malting potential of barley* - A test procedure was worked out in accordance with which all new barley breeding strains are tested in respect of certain malting qualities.

Plant pathological research

(a) *Airborne diseases* - All newly developed breeding strains are being evaluated in respect of particular Sr-genes so that the behaviour of future releases can be more accurately predicted. This work is being supported by wide sampling of natural biotypes that occur in the various production areas throughout the country.

(b) Survey studies show that *Gaeumannomyces graminis* var. *tritici*, the organism that causes footrot, is by far the most widely distributed of all root pathogens and should be regarded as the most important organism from the economic point of view. Research on this organism is now being intensified.

Entomological research

Research on the biology, incidence and control of the Russian wheat aphid *Diuraphis noxia* is being continued, with increased inputs. A work group was constituted from several sources in order to co-ordinate and organise research on a national basis. A considerable amount of information has already been gathered and supplied to producers. A committee consisting of researchers and representatives from the industrial sector meets monthly to exchange information and determine and publicise strategy on control.

During the year under review special emphasis was placed on adaptation trials.

Cultivar and elite trials

(a) Seventy and 56 cultivar trials were planted on dry land and under irrigation, respectively, in the summer rainfall area, and trials were planted at 46 localities in the winter rainfall area. The results make more meaningful recommendations to producers in the various production areas possible in that a national cultivar list and an annual list of cultivar recommendations can be provided. At the same time cultivars that contribute nothing to the industry are eliminated.

(b) Wheat elite trials made it possible finally to release the provisionally released cultivars Wilge and Palala for the Free State and the Springbok Flats. Both cultivars have a good yield potential,

are resistant to rust and possess excellent baking qualities that place them in Class A.

(c) With the release of the wheat cultivar Zaragoza 75 for irrigated areas, a new milestone was reached in terms of yield. Yields of over 8 tons/ha were obtained from this cultivar during the past season.

(d) The barley elite trials resulted in the release of the first irrigated barley cultivar in the country, namely Diamant. The cultivar has a good yield potential and acceptable malting qualities. The final macro brewing trials with dryland barley cultivars are now being held. These trials are expected to give rise to releases.

(e) Many promising strains were identified in the oats elite trials and there is every indication that it will soon be possible to meet the industry's requirements for winter cultivars with longer growing periods.

Supply of foundation seed

Activities in terms of the foundation seed agreement on recommended small grain cultivars concluded by the Department and Sensako increased during the past year. In fact 341 tons of foundation wheat seed, 67 tons of foundation oats seed, 35 tons of foundation barley seed and 3 tons of foundation rye seed have already been supplied to the industry. Signs are already evident in the industry that the quality of small grain seed has improved considerably.

Weedkillers

Trials with weedkillers under both controlled and dryland conditions have provided proof that there is merit in extending the safe stages or hormone spraying of wheat from stages 6 to 9 to stages 7 to 13. The latest results have again confirmed that neither the leaf numbers nor the sheath length of the main haulms can be used as a reliable norm for hormone spraying. The results therefore provide support for the view that the growing point stages are the only reliable norm at present.

Evaluation of pre-emergence and post-emergence preparations on certain weeds, including broadleaf weeds, was continued in the winter rainfall area, with promising results. Where competition from weeds was eliminated, the increases in grain production were up to 77 per cent.

Alternative crops

Preliminary experimental work with alternative crops produced very positive results in the Free State. During a spring planting over 20 tons of material/ha was harvested in the case of some cultivars. A rotational cropping system with wheat and legumes in the summer rainfall area therefore has potential.

Crop physiology

The physiological programme again showed that there is a very strong interaction between day length and temperature in the case of wheat cultivars and that some wheat cultivars are more sensitive than others. Several parameters were investigated in order to quantify drought resistance in wheat, and some of these findings are already being used in the selection programme.

Studies on translocation and photosynthetic activity were carried out and one preliminary observation was that the upper three leaves are responsible for about 60 per cent of the kernel mass.

Plant feeding

Following the results of the 1979 season it was possible to arrive at more definite fertilising standards for wheat, especially in the Free State. These results were used, in co-operation with the Fertiliser Society, to lay down more accurate fertilising guidelines. Recommendations for irrigated wheat still appear to hold. Divided nitrogen applications, leaf spraying with nitrogen and liming have not so far produced significant data in comparison with standard fertilising practices.

In the winter rainfall area additional nitrogen did have a positive effect on certain plant components, including kernel mass and protein content. The division of nitrogen applications might also become an economic practice. Increasing the nitrogen applications for barley creates problems in respect of quality.

Land use and management (winter rainfall area)

The treatments that include fallow are still showing the best results.

Soil cultivation

The programme in the summer rainfall area is getting under way, and the one in the winter rainfall area has produced the following findings:

For the initial deep cultivation the mouldboard still appears to be the best implement.

After four years of clover pastures wheat does well on the same soil without the soil having been cultivated.

Light cultivations are inclined in time to lose their initial advantages over more intensive cultivations.

Climatology

A preliminary approximation map of identifiable wheat areas in relation to several climatic parameters in the OFS has already been drawn up and is undergoing further refinement.

POTATOES

Cultivation and fertilising

Fertilising trials were carried out at Koolbank, Afrikaskop, Bethlehem and Clocolan. Significant responses were obtained with nitrogen and phosphate. At Clocolan, where the phosphate content of the soil was over 70 ppm, no response was obtained with phosphate. In most trials an application of 90 kg of nitrogen per ha was the turning point. Above this no further increase in the yield was obtained.

A trial with foliage killers was carried out at Ermelo. No significant differences between the various foliage killers used were found.

In field trials at Roodeplaat and Ermelo the factors that adversely affect the resistance of potatoes to metribuzin were investigated with several cultivars. In all the trials conditions for growth were so ideal that no or very little damage occurred, even where metribuzin was applied at double strength. There was little difference between the cultivars, although BP-1 and Kimberley Choice showed greater sensitivity to metribuzin.

In another trial where the cultivar BP-1 was treated with metribuzin at various levels before and after emergence, the crop was damaged by the post-emergence treatment, but recovered very quickly and no differences were found between the yields from the various treatments.

In the Free State Region several cultural practices for potatoes were investigated, namely irrigation, fertilising, planting techniques, seed potato sizes, plant populations, planting dates and stage of foliage removal. The cultivars were compared in élite trials and cultivars were tested in spring at various planting dates.

The most important conclusions to emerge from this research are the following:

- The highest potato yield was obtained by irrigating during the reproductive phase at a crop factor (f) of 1,0.
- In comparison with fertilising with 100 kg of N per ha, high nitrogen levels of 200 and 300 kg per ha produced significant increases only in the mass of large tubers (tubers larger than 200 g).
- In comparison with no potassium fertilising, high potassium levels of 150 and 300 kg per ha has also merely increased the mass of large tubers (tubers larger than 200 g) in the crop.
- The highest yield of seed potato size tubers was obtained by planting large seed potatoes (140 to 190 g) and spacing the seed potatoes 10 to 20 cm apart in the row.
- With a spring planting the highest potato yields were obtained by planting as early as the end of August.
- The cultivars Up-to-Date, BP-1 and Buffelspoort produced the highest yields of the spring plantings at Glen. Up-to-Date was glassy when harvested in February, and BP-1 was severely infected with brown scab *Streptomyces scabies*. The cultivar Buffelspoort produced the highest marketable

mass of potatoes with a planting during the spring of 1979.

Moisture stress studies with potatoes were carried out in the Natal Region and it was found that moisture stress during the first nine weeks after emergence had little effect on the yield of BP-1 potatoes. It did, however, have a major effect on quality, because 20 per cent brown scab and 35 per cent malformation occurred, *inter alia*. Moisture stress during the second half of the growing period (10 to 15 weeks post emergence) had no effect on quality, but did reduce the yield of BP-1 by 25 per cent.

Cultivar development and evaluation

In the Winter Rainfall Region trials were carried out at four localities in spring and three in autumn. New breeding strains from Roodeplaat were compared with existing cultivars in respect of yield, resistance to disease and infection with plant viruses.

Two strains, namely Astrid and 71-33-11, performed so well throughout the entire country with regard to these characters that it was decided to release them as new cultivars. In the autumn planting Astrid produced an average of 38,1 tons/ha as against 26,5 tons/ha from Vanderplank and 22,8 tons/ha from BP-1. In the spring planting Astrid produced an average of 70,8 tons/ha over two years. The average production of BP-1 over this period was only 51,64 tons/ha, however. Astrid can therefore be grown very successfully in both spring and autumn. Strain 71-33-11 did not yield quite as well as Astrid, but did nevertheless produce 62,28 tons/ha in the spring planting.

Since there is a great demand for good early cultivars, the Department gave a lot of attention to this matter. An overseas cultivar, Marfona, performed very well in the past year's trials and is undergoing further testing as an early cultivar.

In order to improve cultivar recommendations in respect of quality and keeping quality, a series of trials was started during the past year in order to test the soil storage potential of cultivars.

Diseases

The potato late blight forecasting service for the Highveld and Natal again functioned successfully during the past summer. Information conveyed to farmers in most cases enabled them to eliminate a few fungicidal sprayings. Timely warnings were issued whenever the disease posed a threat in any area.

The most important tuber diseases, black scab *Rhizoctonia solani* and brown scab *Streptomyces scabies*, frequently occur in the potato production areas. Races of brown scab that have a tolerance of sour soil conditions have spread to many of the production areas where the disease was formerly almost unknown. Field trials show that the most successful single control measure for these diseases is the soil fungicide quintozene, which is applied at planting. Thorough mixing of this preparation with

the soil in the area where the tubers develop is required for satisfactory results.

Insects

Snout beetles *Sciobius horni* are still doing considerable damage, especially in certain parts of the Eastern Free State. Damage was satisfactorily limited in trials by the application of gamma BHC.

Potato tuber moth *Phthorimaea operculella* is a serious problem in stored potatoes. Trials with certain fumigants produced disappointing results.

Aphid surveys in the Transvaal Highveld have shown that the chief migration period of the two most important potato virus vectors, namely *Myzus persicae* and *Macrosiphum euphorbia*, occurred two to three weeks later in most areas than during the previous season. This was of considerable assistance to seed potato producers in that it made it possible to postpone the date for foliage destruction. The later migration is ascribed, *inter alia*, to a wetter 1979/80 season and again demonstrated the major effect of climatological conditions on the flight patterns of the aphid.

Research on the black maize beetle *Heteronychus arator* was continued. According to light trap catches the beetles fly and spread mainly from January to April. From September to December the number of flights is less than 5 per cent of the figure for the early part of the year.

Surveys have shown that if potato fields are fumigated against nematodes at the start of the season black maize beetles and their larvae are also killed and the fields remain fairly free of the pest until the population starts increasing from the middle of January onwards. However, the beetles that fly into the fields from outside are capable of doing a lot of damage to the potatoes if the potatoes are left in the soil and exposed to the large numbers of beetles that appear, particularly during February and March.

COTTON

Breeding and selection

A new cultivar, OR3, a selection from Acala SJ1, was registered and released for cultivation; it is especially well adapted in the Upington area. The cultivar is tolerant of *Verticillium dahliae* and "red death", but is susceptible to *Xanthomonas malvacearum*. OR3 produces a coarser and shorter fibre than Cape Acala.

A few crossing combinations with a high resistance to *Xanthomonas* and *Alternaria* were selected at Vaalharts.

At Loskop three breeding strains were developed from the crossing AET X G2.1/17/904. These strains made a promising show in yield trials at Upington, Vaalharts and Loskop and displayed a fair degree of tolerance towards the disease complex in each area.

It appeared from the results of the national cotton cultivar trials that Deltapine 61, Clarcot Acala and Clarcot Alber merited registration as cultivars in the Republic, which would offer a solution to the cultivar problem in certain areas.

Pest control

Early in the season insect populations, especially populations of *Diparopsis castanea* (red bollworm) on ratoon cotton, reached infestation levels that exceeded the economic threshold values. Ratoon cotton had to be sprayed 17 times in all, whereas cotton planted in October, as usual, received only 10 sprayings.

It was shown that red spider mites are more and more rapidly building up resistance to Hostathion (triazophos).

SUNFLOWERS

The national sunflower trials were conducted during the 1979/80 season for the sixth successive year. Sixteen commercial cultivars, 11 of which were high-in-oil and five open-pollinated, including one low-in-oil cultivar, were evaluated at 35 localities. These 16 cultivars were evaluated together with 20 other "new" high-in-oil cultivars in enlarged national cultivar trials at 12 different localities.

As a result of conditions being exceptionally favourable for *Sclerotinia* stalk and head rot *Sclerotinia sclerotiorum* in certain cool, moist, high-lying areas, much greater damage was caused by this disease this year. This resulted in two trials failing because of very severe head infection and the slightly premature harvesting of a trial in order to minimize damage. Most new cultivars exhibited good resistance to rust *Puccinia helianthi*.

The average seed yield of the dryland trials was 2,2 t/ha. Seed yields of over 3 t/ha were produced where the rainfall was favourable, while in parts of the Orange Free State and areas of the Western Transvaal the rainfall was low and poorly distributed and mean yields of the order of 1 t/ha were produced.

The mean seed yield of the three irrigated trials was 3,3 t/ha, while one cultivar produced more than 6 t/ha of seed on the best site. The top-performance, commercial high-in-oil hybrids once again performed well, were generally most impressive and yielded approximately 43 % higher under dryland conditions than the open-pollinated variety Smena.

The top yielder in previous years, Kortrus, which is a low-in-oil, open-pollinated variety, yielded appreciably lower this year and certain hybrids outyielded it for the first time. This poorer performance of Kortrus is attributed to greater disease infection in the moister areas and to drought in others. The new cultivars yielded as well as the best commercial cultivars and the overall standard was most impressive.

The mean oil content of the seed of top-performance hybrids was usually between 43 % and 46 %, whereas that of open-pollinated varieties was only 38 % to 41 % and that of the low-in-oil Kortrus only 29 %.

The top-performance hybrids with a high oil concentration produced the highest oil yields per hectare, and the open-pollinated varieties produced the lowest oil yields. Differences in protein

concentration of the seed and protein yield were also observed.

CHICORY

The study on the growth and development of chicory was concluded. The results showed that the current practice of harvesting the root seven months after planting is correct, but that yield alone cannot be taken as a criterion of harvest readiness. The sugar and fibre contents of the root are the most important factors that determine harvest readiness. Both these properties reach an optimum value about seven months after planting.

Preliminary results indicate that the autumn months are the best time for planting chicory because the incidence of certain pests and diseases, particularly nematodes and black rot, is reduced by autumn planting.

The production of local chicory seed is receiving high priority. Locally produced seed was compared with imported cultivars in trials at eight localities in the production area during the year under review. The results showed that yields from the local seed were as good as - and in six cases better than - yields from the imported seed.

The chicory selection programme is still showing good progress and the results of the progeny tests show that yields are already exceeding those from imported seed. A study of the sugar content of the progeny shows an improvement in this quality character as well.

SISAL

Results of the population and fertility research project which was recently terminated were presented at a national sisal day at Hluhluwe, Zululand. Significant responses to applications of nitrogen at high populations made an impact on growers, who are now receiving over R650/ton of fibre.

The industry is facing an impending shortage of fibre due to increased demands for natural fibre, following rises in the price of polypropylene. Fibre may have to be imported in the near future if production is not able to keep pace with the demand. Fertilising at high populations could help to alleviate the position.

PYRETHRUM

Increasing interest has again been shown in this crop, and enquiries have been received from the USA and Europe about possible regular supplies. The single grower, who farms in the Eastern Cape Region, has expanded his plantings and is continuing to expand. He has made arrangements for the determination of active content and for processing, so that the extract, rather than dried flowers, can be exported. So far only dried flowers have been exported.

Plant nutrition

During 1979 a major soil acidity research programme was initiated by the Summer Grain

Centre on soils of the Avalon, Normandien, Balmoral and Farmhill series.

Preliminary glasshouse studies clearly demonstrated that organic matter was playing a hitherto unreported role in the induction of yield depressions at near neutral pH levels.

Results obtained to date from both the glasshouse and field studies have further demonstrated that lime requirement indexes based on aluminium measurements are superior to those based on pH, and that the near neutral pH levels traditionally considered optimal for maize are unnecessary or even harmful on many acid subtropical soils.

A six-year N, P, K calibration study was completed during 1979. Average least cost NP combinations were calculated and evidence was presented to show that N requirements cannot be reliably calculated on the basis of linear response.

A three-year study into the effect of nematodes on nutrient absorption by maize was completed during 1979. Nematodes were shown to affect uptake of P, K, Ca and Mg significantly. P and K uptake were very markedly increased after soil fumigation and increased K absorption resulted in severe depressions in Mg and Ca uptake.

During 1979 a follow-up experiment was put down to examine the practical significance of these findings.

In recent years there has been a tremendous proliferation in the types of liming materials available to South African farmers. Farmers are consequently faced with difficult decisions as far as selection of the best material is concerned.

In an effort to clarify the situation the Summer Grain Centre has compared 40 such limes in terms of Ca and Mg content, fineness, neutralising value in HCl and neutralising value in NH_4Cl .

Fineness and Ca and Mg content - the parameters controlled by legislation - have proved to be poor indicators of actual quality. Similarly, neutralising value in HCl has provided misleading indexes of efficiency. Neutralising values determined with NH_4Cl have been far better related to actual pH effects on incubated soil samples.

The effects of hardness have clearly emerged and several chemically pure and fine limestones of hard dolomitic origin have been shown to have an efficiency well below that with which they are currently credited.

TOBACCO

Breeding and selection

The breeding programme is aimed at producing high-yielding tobacco cultivars with resistance to diseases and pests and the ability to produce tobacco of high quality. Valuable breeding material has been obtained from overseas and is being utilised.

Flue-cured tobacco

The new breeding strains B61 and 17TL30 are resistant to tobacco mosaic virus (TMV), powdery mildew (*Erysiphe cichoracearum* DC) and black shank (*Phytophthora nicotianae* B. de Haan var. *nicotianae*). They also have highly acceptable quality characteristics and their performance is very stable in different environments, and from one season to the next. These two breeding strains will be released as new cultivars in 1980.

Air-cured tobacco

Progress has been made with the introduction of resistant OSB, Piet Retief Swasie and Red Tobacco and five very promising air-cured cultivars were obtained from South America. Several very promising strains were developed in the phytotron and tested in the field.

Planting methods

Flue-cured tobacco

Densely spaced, deep-topped low-profile flue-cured tobacco produced considerably higher yields than conventional tobacco. The tobacco matured earlier and was easier to sort. The same result was obtained over several seasons with various planting times.

Light air-cured tobacco

Low-profile methods were also successfully applied in the case of light air-cured tobacco. Dense plant espacement and the deep topping of plants, which produced 480 000 to 560 000 leaves/ha, again resulted in good leaf size, production and quality.

Oriental tobacco

The reduction in the crop size experienced with the harvesting of whole plants was eliminated by partial leaf harvesting and by restricting leaf numbers per plant by means of topping. Densely spaced plants topped to a manageable number of leaves per plant produced high yields of good quality tobacco.

Cultural practices

Induced ripening

The ripener Ethrel underwent further testing on flue-cured tobacco at various localities. The limited leaf numbers per low profile tobacco plant ripened very evenly and responded very well to an application of Ethrel.

Irrigation

A combination of ridging and sprinkler irrigation produced the best results on the Arcadia Series at Rustenburg. It was found that leaving the first irrigation after transplanting as late as four weeks produced beneficial results throughout the entire planting season. The indications are that postponing it for longer is harmful, especially later

in the season, and may cause permanent damage during hot, dry weather.

Wheat/tobacco crop rotation

Tobacco grown in furrows or on ridges directly after wheat, without any intervening cultivation of the soil, responds positively to the application of nitrogenous fertiliser. Without nitrogen fertilising it yields poorly and produces an unsatisfactory quality.

Chemical sucker control

In addition to the fatty alcohols that have been registered for some time for use on tobacco, several other preparations are also used. Several systemic and semi-systemic preparations are being tested on tobacco at present and promising results have been obtained. The preparations seem likely to be easier to apply and to extend the control period.

Plant feeding

Pot trials with a sandy soil from the Nylstroom district revealed a boron deficiency. The soil had a high pH (7 to 7,8). The boron deficiency was relieved by an application of borax equivalent to 5 kg of borax per ha. Applications of zinc and boron on a black turf soil produced no significant increase in production, however.

Diseases and pests

Black Shank - *Phytophthora nicotianae* var. *nicotianae*

Metalaxal controlled black shank infection effectively without any adverse effect on yield and quality. The cultivation of buffalo grass for three successive years in a rotational cropping system reduced the black shank population in the soil considerably.

Kromnek

The kromnek virus is transmitted by thrips on tobacco. A systemic preparation has been found that reduces the incidence of kromnek in Oriental tobacco considerably when administered on the soil prior to planting. At the same time this treatment controls bollworm for over two months. The preparation is expected to be registered during 1980 for use on Oriental tobacco.

Residues

The investigation into the residual action of synthetic pyrethroids against the cigarette beetle has been completed. Decamethrin wettable powder was the most effective of the preparations tested.

Phytotoxicity as a result of insecticides

Plants in the glasshouse are generally far more susceptible to phytotoxicity as a result of insecticides than plants in the field. Standard

procedures were established for the comparison of the phytotoxicity of preparations on tobacco under controlled conditions. The symptoms of phytotoxicity and the concentrations at which these symptoms appear are now known for the registered preparations.

Mechanised cultivation of tobacco

In a mechanisation trial carried out on an area of 2,1 ha it was found that when a boom spray coupled to a tractor capable of treating 4 rows at once was used, pest control took 1,31 man hours per ha per treatment. With manual spraying using a 13 litre rucksack spray 15 man hours per ha were required.

When a disk ridger capable of ridging 2 rows at a time was used 1,71 man hours per ha were required for weed control and ridging. In contrast 142 man hours per ha were required when the land was cultivated by hand, using a pick.

Curing

Packing trial with flue-cured tobacco in the bulk curer

In packing trials in which the curing ability and quality of the cured tobacco were evaluated it was found that regardless of the type of container (loading frame - 50 kg net; module - 150 kg net; basket - 150 kg net) or the orientation of the tobacco leaves within the container (tops upwards, downwards or leaves at all angles) there were no differences in the quality of the tobacco.

Curing flue-cured tobacco in the bulk curer

It was found in the course of curing trials in which a commercial curer was used that two problems directly affect the industry and consequently also the farmer's income.

(a) The sponging problem

In the past the farmer received a reasonable price for sponged tobacco, but as a result of the bigger price differentiation between the better and poorer grades that has been introduced by the industry, the farmer now receives virtually no income from sponged tobacco.

Despite the fact that a portable loading frame equipped with a mass meter is used in the field and a drying schedule aimed at reducing sponging is applied, it has been found that 8% of the marketable tobacco does nevertheless sponge. This sponging probably arises as a result of the uneven packing of some leaves in the loading frames, with the inevitable air channelling. The average price for sponged tobacco was only 32c per kg.

(b) Unmarketable tobacco

This problem is a far more serious one. This trial revealed that 35% of the tobacco was unmarketable. In other words, a third of the tobacco which cost time and money to produce, harvest and cure yielded no income. In the course

of this trial a certain degree of wind and hail damage occurred during the latter part of the growing period of the tobacco in the field. In addition, the tobacco did not ripen evenly in the field, which meant that some leaves were either too ripe or too green when harvested. It was chiefly this tobacco that was unmarketable after curing.

Quality

Nicotine status of flue-cured tobacco

A notably higher percentage of light tobacco was produced with a nitrogen fertilising level of 90 kg of N/ha than with 60 kg of N/ha. The percentages of green, orange and mohogany-coloured tobacco did not differ, but the percentage of unmarketable tobacco was lower at the higher N level than at the lower level. The average prices realised for the tobacco and the income per ha were also higher with the 90 kg of N per ha treatment than with 60 kg of N per ha.

Similarly, early topping practices had a notable effect in that they tended to produce a higher percentage of yellow tobacco. Correspondingly, the average yield of marketable tobacco, price and income per ha were higher with early topping than with the late topping treatment.

The effect of the duration of the colouring period in the bulk curer on yield, price and income per ha was not as striking as in the case of the fertilising and topping treatment, but in general a shorter colouring period was more beneficial than a long colouring period.

Reconstituted tobacco

It has been shown that reconstituted tobacco darkens very quickly as a result of a reaction between certain tannic acid derivatives and nitrogenous components such as proteins and amino acids. The presence of 0,5% sodium metabisulphite in the tobacco suspension prevented this browning. Apart from the fact that sodium metabisulphite acts as an antioxidant, it also has bleaching properties that suppress any further darkening.

HORTICULTURAL RESEARCH

WINTER RAINFALL REGION

APPLES

Early red apple cultivar

The release of an early red apple selection bred by the Fruit and Fruit Technology Research Institute is being considered at present. Fruit of this selection ripens about a month before Starking and has an even red colour, with a very pleasant flavour and juicy flesh. Initially this selection is intended for the local market only.

Fertilising

Long-term fertilising trials have shown that the phosphate requirements of apple trees are so low that it would be very difficult to obtain a response to phosphate fertilising under field conditions. Potassium is important, however, in ensuring maximum fruit size, but excess potassium is very harmful because it increases the incidence of bitter pit considerably. Research has shown soil and leaf analyses can be very successfully used to determine the P and K fertilising requirements of apples. Improved guidelines on fertilising will be made available to the industry shortly.

Bitter pit research

The effective application of calcium spraying remains one of the most important factors in the bitter pit control programme. Recent research has shown that the effectiveness of calcium spraying may be virtually doubled by combining the standard range of either calcium nitrate or calcium chloride sprays with calcium hydroxide. The application of this finding in the industry could do a great deal to put paid finally to this troublesome disease.

Effect of organic acids on the movement and fixation of calcium

Bitter pit lesions contained higher concentrations of calcium, potassium, magnesium, oxalic and citric acids. The other organic acids, namely succinic and malic acids, occurred in higher concentrations in the adjacent healthy tissue, and there were no differences in the concentrations of fumaric acid.

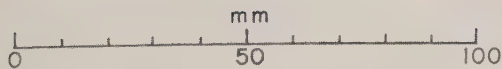
It was found that oxalic acid and citric acid were capable of dissolving the middle lamellas of cells, and field trials showed that apples that later developed bitter pit contained a higher concentration of oxalic acid during the first three weeks of development.

The discovery of the relationship between acids and bitter pit may be considered an important breakthrough which could form the basis for the eventual development of an infallible method of controlling this troublesome disease.

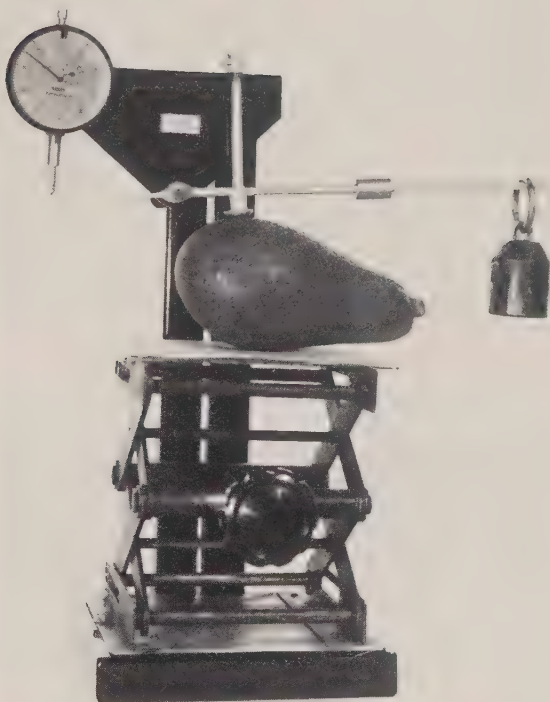
Bruising in Golden Delicious apples

With Golden Delicious, which is one of our most important export apple cultivars, major losses are suffered annually as a result of unacceptable bruising. It was established experimentally that bruising can be kept to a minimum by picking fruit at the correct stage of ripeness, picking during the second half of the day only and exposing the apples to a pre-cooling period of seven days before packing them. It was also demonstrated that by far the greatest percentage of the bruising occurs during packing. Bruising can therefore be kept to a minimum.

This apparatus is used by the Tobacco Research Institute to ensure that sprays are distributed evenly on trial plants



An enormous guava with a mass of 458 grammes, harvested from a seedling tree at the Citrus and Subtropical Fruit Research Institute. Fruit samples from 8 000 guava trees were examined in selection trials



The fermometer developed and built by the Citrus and Subtropical Fruit Research Institute and which is used in conjunction with the micro-wave oven to determine the maturity and ripeness of avocados

Fusicladium (*Apple scab*)

Good progress was made with the investigation into the possible introduction of a fusicladium warning service. It was concluded that a warning service of this kind should prove an asset to the apple industry, if all the relevant aspects are taken into account.

In the Grabouw area it was possible to serve relatively large areas with the aid of a set of observation devices. The pattern of ascospore release was determined in various areas. Peaks were observed around 20 October in the Grabouw Vyeboom area and around 20 November in the Koue Bokkeveld area. By December the source of the spores was exhausted in all areas.

Core rot of apples

Core rot of apples remains a troublesome problem because it develops only during storage. Infected apples may therefore have an adverse effect on marketing at a stage when the cause of the disease can no longer be controlled. It has been shown that four fungi, namely *Alternaria*, *Pestalotia*, *Pleospora* and *Gloeosporium* are mainly responsible for the rot and that penetration of the organisms starts taking place immediately after full bloom. This information is considered a major step forward since it could serve as the basis for an effective control program.

Control of snout beetles in apples

After the embargo on the use of DDT, snout beetles developed from a minor pest into a serious one, particularly in apples. Despite sustained research this remains one of the most important apple pests. This research showed very good progress over the past season. Three insecticides, namely cypermethrin, decamethrin and fenvalerate, were evaluated for the control of the snout beetles in apples. All three preparations provide excellent control of the pest in apple orchards and have the additional advantage that they can even be applied against late snout beetle populations in early January. Apple producers can now control this pest effectively and economically with the aid of these new preparations.

Composition of drupes

The individual sugars that occur in drupes were determined. In plums and prunes fructose and sorbitol together made up 40 % to 53 % of total sugars. These sugars do not have any significant effect on the blood sugar concentration of diabetics. This should be considered in planning the diets of persons suffering from diabetes. In the apricot and peach cultivars examined, these two sugars together made up only 6 % to 25 % of total sugars.

PEACHES

The search for improved cultivars with good canning, drying and dessert qualities is continuing.

In all 32 new peach selections were multiplied for Phase II evaluation. Three of these were canning varieties with sturdy frame branches, three were drying types and 26 were selections suitable for dessert purposes.

PLUMS

Improved plum cultivars

A further three plum selections, all of which ripen early, were multiplied for further evaluation. They all bear good and regular crops of large, attractive fruit, with a relatively high degree of resistance to bacterial spot.

Rootstock evaluation

From preliminary results obtained in respect of the effect of the rootstock on the production efficiency of Songold for three years, from the fourth to the sixth leaf, it appears that virus-free Marianna cuttings performed best, followed by Namaguard and Okinawa, and then Kakamas and Du Plessis seedlings. With Santa Rosa no differences in production potential were observed between the above-mentioned rootstocks. Myrobolan B and, to a greater extent, *Prunus mume* cuttings made very poor rootstocks for both Songold and Santa Rosa.

APRICOTS

Improved apricot cultivars

One selection was found that was very promising as an early canning cultivar. It ripens two weeks before the most important canning cultivar, Bulida, and bears good and regular crops. The fruit is medium to large and has an excellent canning quality, similar to that of Royal. It has already been multiplied in order to undergo further evaluation on a large scale.

Of the over 250 promising apricot selections evaluated for drying purposes, 44 performed well in respect of production, fruit size, fleshiness, colour and appearance of the dried product.

Rootstock evaluation

The rootstock effect and production efficiency of Malan Royal were investigated over a period of five years. The average results for the five years - which covered the period from the fifth to the ninth leaf - indicate that Nemaguard and apricot seedling, and virus-free Marianna cuttings, performed equally well in respect of production efficiency. The performance of Okinawa seedling was slightly poorer and that of Kakamas seedling was the poorest.

It was also found that certain Marianna crossings do not display affinity problems with Bulida and Peekapara apricots. In the case of Peekapara there were two crossings with a better production potential than apricot seedling.

TABLE GRAPES

Improved table grape cultivars

Sixty-eight table grape selections have been planted at the Hex Valley, Bien Donné and Bellevue Experimental Farms. A further 37 are being multiplied this year. These selections consist of white and black and a few red cultivars and their time of ripening ranges from very early to very late. All bear good and regular crops of well-filled bunches with medium to large berries that are resistant to cracking and have a pleasant flavour.

Uptake of sulphur dioxide

It is known that it is necessary to expose packed table grapes to a sulphur dioxide atmosphere in order to prevent spoilage. In the trade gas sheets are placed within the pack for this purpose. Spoilage nevertheless sometimes occurs. It has been found that if the period between packing and cold-storage is too long, the carbon dioxide is initially released at so high a rate that the concentrations present during cold-storage are too low. The problem can therefore largely be controlled by packing grapes at a low temperature (below 20 °C) and chilling them as fast as possible afterwards.

Mealybug control

Following the success obtained with prothiophos for the control of vine mealybug on table grapes, the use of another insecticide with a very long residual action against the pest was evaluated. This preparation is chlorpyrifos, which also provides excellent control of the pest. It has the advantage that it can be applied during late winter, before budding, and therefore causes no residue problems.

Chlorpyrifos belongs to the revolution in the control of mealybug in table grapes that was started by prothiophos. With the aid of these two preparations it is now possible to control mealybug in table grapes more effectively and economically than ever before.

Botrytis

In the course of epidemiological studies of *Botrytis cinerea* in table grapes it was found that vine shoots are infected by the fungus during the post-harvest period via the leaf stalks of infected leaves or lesions where leaves have dropped off.

The fungus survives in infected shoots in two ways, namely as sclerotia or as resting mycelium.

In moist conditions during the growing season the fungus forms conidia on the infected shoots on the ground. It has been established that conidia are formed on the shoots throughout the growing season. *Botrytis cinerea* is also found in lesions and sclerotia are found on various weeds, namely *Oxalis*, *Raphanus* and *Avena* species.

FRUIT TECHNOLOGY

Texture of canned pears

Incorrect storage practices result in texture variations and low quality in canned Bon Chrétien pears. Various stages of ripeness, storage temperatures and periods, and ripening temperatures were investigated. Where pears were stored under suboptimum conditions the storage period during which acceptable canned products are obtained was reduced. If pears are harvested, stored and ripened under optimum conditions, acceptable canned products can still be obtained after 12 weeks of storage.

The texture of hard areas of fruit that has not been properly ripened cannot be corrected by longer processing periods, as is generally assumed. Furthermore, longer processing periods have an extremely bad effect on the appearance of the canned products.

SUPPORTING RESEARCH

Packing and refrigeration of strawberry runners

Strawberry runners used to be supplied to producers in almost any conceivable container. This gave rise to problems such as the spoilage of plants, drying out of the roots and leaves and a poor "take".

A standard pack for strawberry plants has been developed. The plants are lifted, the soil is washed from the roots and the plants are then made up into bunches of a hundred each. The bunches are then placed in 150 gauge polythene bags so that the leaves remain on top. The bunches are then placed in cartons the size of apple boxes, equipped with a shoe-box type of lid, in preparation for consignment or storage. Each carton holds between 600 and 1000 plants, depending on their size.

Plants packed in this way can safely be stored for up to two weeks in a cold store at -0,5 °C without any adverse effect on the plants or any drop in production. This enables producers of plants to supply high quality plant material to strawberry growers.

The growing of kiwi berry plants

The industry has been experiencing establishment problems with kiwi berries, partly because of lodging of the young plants. A method has now been developed for growing plants from seed, without any lodging problems.

The seed, after having been stratified in wet sand at 1 °C for two weeks, is first sown in perlite-filled wooden boxes and germinated in a mist bed. The seedlings are transplanted at the two-leaf stage into perlite-filled peatmoss containers. After a further two weeks in the mist bed, the seedlings are transplanted into planting bags containing sand. Two sprayings of benomyl are applied during the period between germination

and planting out. No problems with lodging occurred where this method was followed.

Dieback of rooibos tea plants

Investigations into the cause of the large-scale dieback of rooibos tea plants have shown that a fungus infection is responsible. Owing to the large wounds made during harvesting the bushes are very susceptible to fungus infection. Preliminary identification of the causative fungus points to a *Phomopsis* pathogen.

SUMMER RAINFALL AREA

PEACHES

The demand for the cultivars bred by the Department was again so keen during the past season that it exceeded the supply. The demand for the early cultivars such as Orion, Earibelle and Albatros was again very keen.

Of the early cultivars Orion was in the greatest demand; Sunray and Safari were the most popular of the yellow desert peaches. These two cultivars appear to do well on the Transvaal Highveld and are very popular on the Transvaal markets.

As a result of the success Imperani has had in the Eastern Free State during the past eight years, it appears that more farmers in the areas where late frost is a problem intend to plant Imperani on a larger scale. Cultivars such as Sunray, Golden Amber and Clocolan again produced good crops of outstanding quality peaches in selected areas in the Ficksburg district.

Breeding and evaluation

The newly imported American cultivar Desert Gold, an early, yellow-fleshed, loosestone variety, again bore an excellent crop of good quality fruit at Roodeplaat. This cultivar, which ripens during late October, holds considerable promise for the areas of the Transvaal Middleveld where late frost does not occur.

The nectarine Sunlite, which was imported from Florida, USA, continued to produce well. The yellow-fleshed, clingstone nectarine has potential for the Transvaal Middleveld. Sunlite ripens early in December.

Fayette and Fairtime, two yellow-fleshed, loosestone peaches that were also imported from America, have done very well. The two cultivars should perform well in the Middleveld and in certain selected areas of the Highveld that are not particularly subject to late frost. They both bear large fruit with a good eating quality. Fayette and Fairtime ripen around the middle of January. Both cultivars are promising for purposes of drying.

Breeding strain 72-190, which was developed at Roodeplaat, made a very good showing. This yellow-fleshed, loosestone nectarine produced large fruit with a very good eating quality. The crop was excellent and the fruit ripened during the middle of December.

The nectarine breeding programme is progressing very well. About 7 000 crossings have been planted out and will now be evaluated. Promising selections are expected to become available in the near future.

CHERRIES

After the decline during the past three years in interest among farmers in expanding plantings of cherry trees, there are indications at present that the cherry industry could expand.

The major problem with which cherry growers have to contend is the long period it takes trees to come into bearing (6 years after planting) and the fluctuations in the size of the crops. Bacterial canker *Pseudomonas morsprunorum* remains a serious disease and cannot be effectively controlled by a spraying programme alone. The increase in infection with bacterial canker after the wet autumn was striking. It was found in the course of preliminary trials that spraying fruit with Ethephon (240 p.p.m.) 10 to 12 days before harvesting causes cherries to ripen earlier and more evenly, which is of great importance where cherries are mechanically harvested.

During the past four years 27 400 certified cherry trees reached the industry through a plant improvement scheme.

TABLE GRAPES

This year the Waterberg Table Grape Producers' Association supplied sufficient grafted plant material to its members to plant about 75 ha. The cultivars planted were Pirobella, Bien Donné, Erlihane, Ronelle and Waltham Cross.

The Association intends to supply a further 150 000 grafted vines to its members during 1981.

The influence of cultivars bred by the Department on the agricultural industry in the summer rainfall area

In 1956 the Horticultural Research Institute started a table grape breeding programme aimed at breeding more suitable cultivars than the ones that used to be planted on a small scale in the summer rainfall area.

The first two cultivars, Pirobella and Muska, were released by the Department of Agricultural Technical Services in 1964. Since then a further five new cultivars have been released by the Horticultural Research Institute and one by the Fruit and Fruit Technology Research Institute. An important characteristic of a number of the new cultivars is that they have a fair resistance to cracking.

These cultivars revolutionised grapevine plantings in the summer rainfall area. For instance, the biggest table grape farmer in the Barkly-West area has planted 140 ha to table grapes during the past 10 years. These plantings consist solely of the new cultivars.

In August 1978 the Waterberg Table Grape Producers' Association was established, with a

membership of 12 farmers. In May 1980 the membership was 80.

During the winter of 1979, 70 000 vines were grafted for these members. Of these vines 83 % were new cultivars. The demand for the 1980/81 season stands at 150 000 vines, 88 % (136 000) of which are the new cultivars.

It is estimated that the work the Department has done for the farming community in the summer rainfall area through research over the past 10 years will ensure the industry a gross income of at least R2 400 000 a year. Owing to the widespread interest that has been aroused in the area, the income obtained from the new cultivars may rise sharply within the next decade.

Breeding

Two new grape cultivars were released by the Horticultural Research Institute. Plant breeders' rights were granted for Ronelle and about 10 000 grafted vines are already available for planting this year. The Waterberg Table Grape Producers' Association plans to graft 75 000 Ronelle vines during the winter of 1980. Ronelle again showed promise this year and it is expected that the cultivar will stimulate the table grape industry in the summer rainfall area and make good exports possible. Ronelle again ripened early in January and produced larger and better coloured berries than Barlinka; moreover there was very little berry cracking.

Rosete grafting material was also released to the nursery industry during the past winter. About 5 ha of this cultivar will be planted in 1980.

Of the grape selections in the final stage of evaluation, BAR/WC 70-1816 (an early black grape), Q/DM 69-1397 (an early white grape), K/WC 70-4775 (a deep pink midseason selection) and AL/BAR 70-273 (a midseason black grape) were outstanding. These selections also possess good resistance to cracking and will be critically evaluated by the cultivar committee of the Institute with a view to possible release.

PECAN NUTS

The pecan nut cultivars at the Horticultural Research Institute at Roodeplaat continued to produce very good crops. Cultivars such as Moore, Bester and Barton again produced the highest yields.

The new cultivar Ukulinga produced as much as 20 kg of nuts per tree in its 10th year after planting. Ukulinga is well adapted in the Transvaal Middleveld and is undoubtedly a very early producer.

VITICULTURE

Cultivar evaluation (Scions)

First-phase evaluation

All the cultivars to be evaluated pass through this screening process before being incorporated in

the scion collection at Nietvoorbij. The object is to build up a gene bank for use in breeding programmes and to serve as demonstration material.

Over the past 10 years 235 cultivars, clones and crossings have been received and the following new cultivars have been made available to the industry:

Bukettraube, Weisser Riesling, Kerner, Heroldrebe, Harslevelii, Nemes Furmint, Fernao Pires, Morio Muscat, Pinot gris, Vital, Bourboulenc, Emerald Riesling and Burger.

The following cultivars and crossings were included in second-phase evaluation trials during the past two seasons:

Rabaner, Mansenc blanc, Zarello cataluna, Erlihane, Bien Donné, Galego farcado, Azal branco, Callagrano, Terret blanc, Planta Nova, Pecs 24, Huxelrebe, Neo Muscat, CG 1272, CG 38049, Reichensteiner and Ruby Cabernet.

During the past season experimental data on 115 new cultivars, clones and crossings was collected and 80 white and 50 red experimental cultivar wines were made.

Second-phase evaluation

This phase involves the determination of the ecological adaptation of screened cultivars, especially with regard to growth vigour, yield, resistance to vine diseases, wine quality and time of flowering and ripening. Trials are being carried out at both experimental farms and on the farms of collaborators.

In 60 trials the viticultural and oenological performance of the following cultivars has been good so far:

Nietvoorbij: Chenin blanc, Sauvignon blanc, Chardonnay, Gewürztraminer, Bukettraube, Weisser Riesling, Kerner, Riesling, Semillon, Colombard, Cabernet Sauvignon, Cabernet franc, Pinotage, Pinot noir, Merlot, Shiraz, Alicante Bouschet and Tinta Barocca

Robertson: Colombard, Chenel, Muscat d'Alexandrie, Muscadet, Bukettraube, Colomino, Flora and Emerald Riesling

Lutzville: Chenin blanc, Colombard, Chenel, Colomino, Raisin blanc, Cabernet Sauvignon and Pinotage

Oudtshoorn: Chenin blanc, Colombard, Chenel, Bukettraube, Pinotage and Cabernet Sauvignon (preliminary results)

Vaalharts: Colombard, Chenel, Pinotage and Tinta Barocca (preliminary results)

Uppington: Insufficient data available as yet

Vredendal: Gewürztraminer, Chenin blanc, Chenel, Colombard, Cabernet Sauvignon, Cabernet franc, Tinta Barocca and Pinotage

Rawsonville: Bukettraube, Colombard and Chenel

Agter-Paarl: Cabernet Sauvignon, Cabernet franc and Pinotage

Montagu: Chenin blanc, Gewürztraminer, Chenel, Colombard, Bukettraube

Durbanville: Cabernet Sauvignon, Cabernet franc, Pinotage, Tinta Barocca and Shiraz

Klawer: Chenin blanc, Bukettraube, Colombard, Chenel, Cabernet Sauvignon, Cabernet franc, Pinotage, Tinta Barocca and Shiraz

Malmesbury: Tihta Barocca, Cabernet Sauvignon, Cabernet franc, Pinotage and Shiraz

Wolseley: Bukettraube, Chenel and Chenin blanc

Bonnievale: Bukettraube, Gewürztraminer, Chenel and Colombard

Ladismith: Bukettraube, Colombard, Chenel, Cabernet Sauvignon and Cabernet franc

De Rust: Cabernet Sauvignon, Cabernet franc and Pinotage

Oudishoorn (experimental farm): Bukettraube, Colombard, Chenel and Colomino

For all these trials data on the viticultural and oenological performance are required over a far longer period before final recommendations can be made on adapted cultivars for the various areas.

Third-phase evaluation

This aspect, which comprises the selection and evaluation of clones of all commercially important cultivars, is one of the most important methods of ensuring that the best propagating material is used in the industry.

The present position with regard to selection is summarised in Table 1. After the final evaluation of clones of Chenin blanc, Colombard and Muscat d’Alexandrie had been started, it was decided to subject material of the other highly important cultivars, such as Cabernet Sauvignon, Shiraz, Cinsaut, Pinotage etc., to virus purification before beginning the final evaluation.

TABLE 1 - The present position with regard to clone selection and the evaluation of the most important wine grape cultivars

Cultivar	Clones selected	Clones in final evaluation	Clones receiving heat therapy
Chenin blanc	55	16	11
Colombard	13	6	6
Muscat d’Alexandrie	41	36	6
Cabernet Sauvignon	17	-	21
Cabernet franc	7	-	10
Shiraz	7	-	12
Cinsaut	24	-	7
Pinotage	9	-	4
Riesling	11	-	4
Clairette blanche	12	-	3
Merlot	-	-	6
Chardonnay	-	-	6
Weisser Riesling	-	-	13
Sultana	93	9	5

Virus purification

Seventeen scion cultivars have been handed over to the multiplication organisation and 126 are being subjected to virus purification. This task is being carried out in co-operation with the Plant Protection Research Institute.

Cultivar evaluation (rootstocks)

Adaptation in various areas

Fourteen field trials have been undertaken in order to make long-term recommendations on the suitability of material for varying soil conditions. The most important recommendations that can be made at present are given in Table 2.

In addition to production, however, it is necessary to take several other characteristics into account before final recommendations can be made for an area. Resistance to root diseases and insects, drought tolerance and other factors all play their part. New trials, in which heat-treated material will be used, will begin shortly.

Progress with virus purification

Good progress has been made with virus purification and 14 cultivars (25 clones) have already been released to the multiplication organisation. Thirty-four clones are undergoing heat therapy at present at the Plant Protection Research Institute; 7 of these are in Phase 5 and should soon be released.

Cultural aspects

Pruning methods for Cabernet Sauvignon

The most important high quality red wine grape cultivar, Cabernet Sauvignon, accounts for about 12% of the total stand of red wine grape cultivars at present and makes up about 6% of new red grape plantings. The bunch mass of this cultivar is about half that of Cinsaut. Cabernet Sauvignon is therefore usually cane-pruned in order to obtain an acceptable unit yield. In an attempt to improve the budding percentage and consequently the yield of Cabernet, a pruning trial was started at Nietvoorbij in 1975. The latest results show that the best budding percentage is obtained with the spur pruning method, but that the bunch masses are highest with unbruised horizontal canes. These results indicate that there are two alternative methods of obtaining the highest yields from Cabernet Sauvignon, namely i) with short bearers, boosting vine development to such an extent that the same number of eyes are obtained as with long bearers, or ii) with cane pruning, improving the budding percentage in one way or another.

Suckering wine grapes

Suckering as a summer practice is strongly recommended. In order to study the advantages and disadvantages of suckering in relation to the physiological response of the plant, a trial with Chenin blanc x 99-R was started at Nietvoorbij in 1977. The results so far have shown that the vine largely compensates for shoots and grapes removed during suckering. This compensation takes place through the formation of longer and thicker shoots and larger and heavier bunches.

TABLE 2 - Order of preference, on the basis of production, of rootstocks in various areas/growing conditions

Situation	Soil form	Preference									
		1	2	3	4	5	6	7	8	9	10
Wellington	Glenrosa	99-R	101-14	3306	143-B	333					
Paarl	Clovelly	101-14	143-B	3306	Jacq.	S.Cr.					
Vredendal	Clovelly	99-R	Rup.d.L	110-R							
Vredendal	Oakleaf	99-R	143-B	Metallika	101-14	S.Cr	110-R	Rup.d.L	3306		
Stellenbosch	Clovelly	110-R	99-R	143-B	3306	420-A	S.Cr.	101-14	Rup.d.L	Teleki	
Robertson	Shortlands	99-R	110-R	143-B	101-14	S.Cr.					
Lutzville	Hutton	101-14	110-R	Metallika	99-R	S.Cr.	de Waal	Rup.D.L	143-B	3306	Jacq.

Disease control

Phytophthora root rot

Research during the past season has shown that soil fumigation with methyl bromide at 125 g/m² and with Basimid at 50 g/m² kills *Phytophthora cinnamomi* in the soil. Both preparations can therefore be used for the treatment of soil prior to the establishment of vines in nurseries or in planting holes in established vineyards to replace vines that have died. The fungus can therefore now be controlled in the soil prior to planting and, as indicated in previous reports, it can also be controlled after planting by means of systemic fungicides such as Aliette and Ridomil. The control of the disease by the chemical and hot-water treatment of winter wood has already been perfected, with the result that it is now possible to control *Phytophthora* in vineyards at all stages of the physiology of the vine.

The effect of virus status on rootstock susceptibility to *P. cinnamomi*

The rootstock cultivars 99-R clone 1/30/1 and Prosperi Super 99-R subclone 5 were compared by the PPRI after heat therapy with the same material infected with vlek virus and leaf roll in the first case and stem-pitting and leaf roll in the second case. The results showed that not only did heat therapy result in better root development but no lowering of resistance to the root fungus disease could be observed.

Aploplexy in vines

Strong indications were obtained in the course of a survey that cultivar differences exist in respect of susceptibility to this disease. Palomino (French) and Chenin blanc (Steen), for instance, show greater susceptibility than Pinotage and Cabernet Sauvignon. Studies also show that where clean cultivation is practised there is a significantly lower incidence of the disease than in the case of cultural methods where the growth vigour of the vineyard is hampered. In order to identify the causative organism, large numbers of pruning wounds were studied and thirteen different species of fungus were isolated. Four of these organisms, namely *Botryodiplodia*, *Eutypa armeniaceae*, *Phomopsis viticola* and a *Sclerotium* sp. are undergoing further study as possible implicated organisms.

The effect of anti-Botrytis preparations on currants

In a spraying trial in the Worcester district PCPA, gibberellic acid (Berelex) and the fungicide iprodione (Rovral) were administered together and separately for the control of *Botrytis cinerea* rot of currants. The results show that all the above preparations increased the berry size and improved fruit set. PCPA and Berelex were associated with increased *Botrytis* infections, but Rovral provided good control. The latter preparation therefore had a dual action in this case: it controlled *Botrytis* rot and increased berry size.

Entomology

Margarodes

Extensive studies on the biology of two *Margarodes* species that attack vines, namely *M. capensis* and *M. vredendalensis* were carried out under both laboratory and field conditions. It was found that it will be possible to apply chemical control only against the cyst stage. The insects, however, occur at a depth of up to 1,2 m in the soil and propagate themselves by parthenogenetic means - and very rapidly. These findings indicate that margarodes, like phylloxera, are very difficult to control by chemical means.

Snout beetles (weevils)

With the recent withdrawal of DDT snout beetles have become an increasing problem in virtually all viticultural areas. Following representations from the industry regarding poor control, a field trial was carried out in order to evaluate the effectiveness of the preparations already registered and the new synthetic pyrethroids (permethrin, fenvalerate and cypermethrin) for the control of *Eremnus cerealis*. The results here and in the follow-up field trials showed that acephate or any of the pyrethroids can provide good control if one or two sprayings at most are properly applied at 3 to 4 week intervals.

Vine mealybug

Vine mealybug, which is a widespread pest in virtually all the viticultural areas, is becoming an increasingly serious pest of wine grapes. Since existing preparations have been tested on table grapes only, a field trial was carried out to determine the effectiveness of some of the preparations and of a promising new preparation (chlorpyrifos) for wine grapes. The preparations

tested were: methiocarb 80 % wp; fenchlorphos 40 % ec; dichlorvos 50 % ec; methidathion 40 % wp; omethoate 80 % ec and chlorpyrifos 48 % ec.

These preparations all produced good control and no statistical differences could be found between them.

Irrigation and moisture studies

Data of great practical value are being obtained in an irrigation project at Robertson in which soil moisture levels, degrees of moisture stress during critical stages of growth, and irrigation systems are being compared for their effect on growth, bearing and quality aspects of Colombard grapes. Poorer shoot growth is obtained both at the lowest moisture level and with drip irrigation. It has also been found that moisture stress during fruit set has a negative effect on berry volume. Furthermore, the highest fruit set was obtained during two successive years in which the soil moisture content during the flowering period was kept at a high level.

This trial also shows that the sugar content is higher and the acid content lower in treatments that receive water less regularly. Grapes in the latter treatments were harvested up to three weeks earlier than grapes in a treatment irrigated two or three times a week. Intensive plant physiological studies are at present being carried out on this project in an attempt to find explanations for the effects produced by irrigation.

Fertilising and soil preparation studies

Results obtained with differential fertilising of a vineyard on medium potential soil in the Stellenbosch area have shown that the uptake of nitrogen may be suppressed by excessive applications of potassium. Since grapes with higher nitrogen contents are more inclined to rot, better wine was made during the 1978/79 season, during which rot was widespread, from grapes derived from plots that had received high potassium fertilising.

During seasons in which little rot occurred, however, there were no significant differences in wine quality. On the contrary, there were indications that the lower nitrogen content of must derived from premises that had received high potassium fertilising could lead to retarded fermentation and possibly lower quality wines. The necessity for a correct balance with regard to potassium fertilising is therefore strongly emphasised by these results.

The application of lime during soil preparation is necessary for many vineyard soils in the Western Cape. A new type of lime applicator ("lime blower") mounted on a trench plough and a subsoiler was compared with conventional methods of lime application for effectiveness. The distribution of the lime was investigated with the aid of fluorescent pigments and night photography under ultraviolet lights. The method where lime is applied to the surface of the soil before trenching produced surprisingly good results in comparison

with the conventional method in which one part of the lime is applied against the slanting bank of the furrow. It has been demonstrated beyond doubt that double trenching is essential for mixing the topsoil and subsoil adequately and obtaining a good distribution of lime to a depth of about 800 mm.

OENOLOGY

Wine chemistry

Factors that determine the repeatability of the formation of wine flavouring substances and wine quality:

Experiments carried out during the past season confirmed findings obtained in a winery experiment carried out in 1978, namely that during anaerobic fermentation completely clear grape must produced better quality wines (70 % on average) than must that had merely been settled (50 % on average). In the case of the former method, however, important substances required by yeast for growth, e.g. ergosterol, are removed from the must by filtration and under anaerobic conditions this results in retarded fermentation. It is therefore essential to stimulate the fermentation of filtered must, e.g. by the addition of settled must, ergosterol or oxygen by means of carefully controlled aeration during fermentation. Following the experimental application of the above-mentioned principles during the past year, the addition of 45 mg/ℓ of ergosterol produced the best quality wines.

Short-term international OIV investigations into the chemical aspects of the products of the vine:

Since South Africa is a member country of the OIV, the OVRI was asked to investigate the cadmium content of South African wines as part of an international effort. It was found that cadmium concentrations in South African wines are below the maximum permissible amount, as specified by the OIV and the Codex Alimentarius.

Winery technology

Investigation into the effect on wine quality of limiting the crop of selected cultivars

Crop limitation by means of breaking off two-thirds of the bunches when the berries are the size of peas was carried out on the cultivars Chardonnay, Kerner, Weisser Riesling, Sauvignon blanc, Bukettraube and Chenin blanc. Organoleptic judging by a panel of tasters showed that fuller wines with a more pronounced cultivar character are obtained through the application of this practice.

Wine microbiology

Evaluation of dry yeasts

This project was dealt with in two phases during the past year; retarded fermentation was investigated

It was demonstrated that the keeping quality of yeasts differs considerably. As an example, strain WE 14 *Saccharomyces cerevisiae*, produced in 1979, proved to have a considerably better keeping quality than Montrachet and Epernay, so that the former could possibly be kept for use the following season.

Experiments also showed that, contrary to the general belief that race 228 produces neutral wines, wines prepared from this yeast race had a higher content of glycerol, fatty acid esters, fixed acids and ethanol and a higher extract concentration than wines made from other yeasts. It would therefore appear that race 228 could be responsible for fuller and more aromatic wines.

In trials in which the effect of the yeast race on the incidence of retarded fermentation was investigated, it was shown that where retarded fermentation occurred the yeast race produced smaller quantities of ergosterol. In two independent experiments it was found that races 228, WE14 and WE372 produced low quantities of ergosterol, whereas Epernay and Montrachet formed considerably larger amounts of this compound.

Reduction of the sulphur dioxide concentrations in wines

Yeast races which in laboratory trials had seemed likely to increase glycerol in wine and reduce acetaldehyde concentrations were tested with four cultivars, namely Chenin blanc, Colombard, Pinotage and Cabernet Sauvignon. The races WE14, WE372, WE377 and WE1 can be recommended for the production of wines with a low demand for sulphur dioxide as a result of a low production of acetaldehyde, good wine quality being realised at the same time.

Laboratory trials have already shown that lower acetaldehyde concentrations in wine can also be obtained by manipulating the fermentation temperature. Trials on a larger scale have confirmed these findings, with the retention of wine quality.

The taxonomy of malolactic acid bacteria

119 of the 155 malolactic acid bacteria underwent further characterisation with a view to identification according to Bergey's *Manual of Determinative Bacteriology*. Of these 52 of the 79 *Lactobacilli* proved to be homofermentative. Thirty-six of these isolates were classified as *Lactobacillus plantarum*. A group of 10 isolates showing certain similarities to *Lactobacillus casei* differ in certain important properties, so that they may represent a new species. Five of the isolates showed no similarity to any of the known species.

The group of 21 heterofermentative isolates consisted of 1 isolate which may be *Lactobacillus brevis*, with a few deviant properties, and 20 isolates with properties corresponding to those of an identified heterofermentative *Lactobacillus* isolate previously isolated in South African wine by L. de W. du Plessis. This group is probably a new species not yet described in the literature.

A group of 6 *Lactobacillus* isolates showed gas formation from glucose in a modified Rogosa medium but not on a modified MRS medium. These isolates were described as homofermentative or heterofermentative *Lactobacillus* sp.

The 97 leuconostocs were identified as different races of *Leuconostoc oenos*. Although a few of the 13 pediococci possess deviant properties, their most important properties show that they must all be races of *Pediococcus pentosaceus*.

Considerable progress has therefore been made with the identification and classification of possible AMG bacteria. Certain races have already been found to be good AMG converters. AMG has been induced in the laboratory and in small-scale fermentation, but problems are still being experienced with induction on a larger scale.

LIQUOR CONTROL

Wine certification scheme under Act 25 of 1957

Table 3 contains a summary of the quantities of wine certified for sale by the Wine and Spirit Board, with indications of origin (estate wines included), vintage or grape cultivar.

TABLE 3 - Certification of wines of origin and vintage and/or cultivar wines

Type of wine	Total certified		Superior quality		Special quality	
	HL		HL	%	HL	%
Natural wines	198 886		18 420	9,3	180 466	90,7
Liqueur and other fortified wines	46 188		3 274	7,1	42 914	92,9
Total	245 074		21 694	8,9	223 380	91,1

According to the figures given in Table 3, the volume of natural wines certified constitutes 81 % of the total volume certified - a pattern that has been noticeable since the introduction of the origin system in 1973. It should be noted that fortified wines are certified chiefly for exporting to the United Kingdom and that only a small quantity of wines of this type are used for the local market. It is also interesting to note that the total volume of natural wine certified during the 1979 calendar year amounts to 10,3 % of total sales (in South Africa and abroad) of this type of wine.

Inspection of rebate wine, rebate brandy and wine spirits

Table 4 contains particulars of the inspection for quality by the Government Brandy Board of wine intended for distilling into rebate brandy and the certification of such distillate, and of wine spirits, as being suitable for the manufacture of brandy and other potable alcoholic beverages.

TABLE 4 - Certification of rebate wine, rebate brandy and wine spirits

Type of beverage	Total inspected		Approved	Percentage rejected (Volume)
	Samples	HL	HL	
Rebate wine	2 117	1 113 392	1 044 880	6,1
Rebate brandy	395	112 928	112 624	0,26
Wine spirits	762	314 949	309 739	1,6
Low-strength spirits	121	41 268	40 312	2,3

Control over export liquor under the liquor export regulations

A total of 2 695 samples of export liquor, representative of 89 883 hl of wine and spirits, were inspected for quality and chemically analysed by the Wine and Spirits Board during the past year. Of this quantity, 89 404 hl was certified for export.

The declining trend in total exports of South African liquor over the past few years is still discernible, although there have been signs of stabilisation during the past three years. This trend may be ascribed to the gradual decrease in the export of fortified wines in bulk, which used to make up by far the greatest volume of export liquor.

It is very encouraging to note that exports of high quality bottled natural wines have increased considerably, especially during the last three years. This has largely compensated for the decline in bulk exports. This is illustrated by the fact that exports of bottled wines constituted 13,6 % of total exports three years ago, whereas they now amount to 45,4 %.

Control of imported liquor

All imported liquor is controlled in co-operation with the Department of Customs and Excise to ensure that it complies with the requirements of Act 25 of 1957. Consequently 1 075 samples of liquor underwent chemical analysis by the routine analysis laboratory of the OVRI. In addition these samples were inspected for labelling. A total of 69 samples of such liquor were rejected for defects of one kind or another in terms of the Act.

Local liquor inspection service

Two liquor inspectors responsible in terms of Act 25 of 1957 for the inspection of all licensed liquor manufacturing and sales premises in the Republic paid surprise visits to 1 531 premises during the past year in order to inspect them.

Two court cases resulted from these inspections and both the licensees concerned paid admissions of guilt.

It is notable that the number of irregularities and judicial prosecutions has gradually declined during the past few years. This indicates that licensees are being kept on their toes by this inspection service.

A further two inspectors responsible for control over the manufacture of certified wines by the KWV paid 235 surprise visits in order to

inspect KWV premises. A further 16 inspections were carried out at the wineries of private producers in order to check on the certified wines bought by the KWV.

Eighty-four samples for preliminary certification and 260 samples for final certification, representing 64 300 hl of wine, were checked by these inspectors and submitted to the Wine and Spirits Board.

Routine analysis service

The routine analysis laboratory of the OVRI carried out a chemical analysis of a total of 16 454 liquor samples during 1979. This service is performed in respect of all liquor, including export and import liquor, and wines for certification, which have to be analysed in terms of Act 25 of 1957 in order to determine whether they comply with the legal requirements for composition before they may be sold. This laboratory also serves as the only official centre for the analysis of alcoholic liquor on behalf of other Government Departments, and for the routine analysis of experimental wines made by the OVRI.

CITRUS

Citrus Improvement Scheme

The vast majority of adult citrus trees in the country are infected with one or more viruses that retard tree growth, limit production and reduce the life of the trees. Virus purification of the existing clones is receiving a great deal of attention. When virus purification has been completed the clones will undergo horticultural evaluation and will then be multiplied in a foundation block (which will be administered by the Citrus Exchange), after which certified super plants will be made available to the industry.

Seedling method

Most of the well-known citrus viruses are not transmitted by seed. Since citrus is propagated almost solely by seed, an experimental farm that is virtually completely isolated from other citrus trees has been developed on the banks of the Limpopo near Messina. There are already 8 000 trees, the oldest of which is 10 years old. There are only three enterprises of this sort in the world and the one near Messina is by far the biggest of its kind.

Growing point grafting

In order to carry out virus purification on seedless kinds or kinds that are not genetically pure when propagated by seed, a new technique was taken over from overseas and refined. This technique, namely growing point grafting, is carried out on vegetative material and has already been successfully carried out on about 50 clones.

Looseskin cultivars

Just as fashions in clothing and music change, there are changes in preferences and prejudices in respect of food and specifically fruit, and this has its effect on modern technology. The European consumer of citrus fruit has slowly developed a very strong preference in favour of an easily peeled citrus fruit with few seeds. This has resulted in breeders throughout the world attempting to breed easy peeler naartje crossings that will satisfy the consumer but will still have sufficiently firm fruit and skin to be transported over long distances. This challenge has been accepted by our researchers and numerous imported selections are being evaluated against local crossings and selections. The results of trial consignments have already elicited very favourable comments on the local products.

Microjet irrigation

Microjets were developed on South African soil and are applied in this country. The success of this system has attracted attention in both the USA, which imports the local product, and Australia and Israel, which manufacture their own products, based, however, on the South African microjet.

Microjets contribute to the more economical and efficient use of water. They reduce manual labour enormously and increase managerial efficiency. In addition it is possible to apply soluble fertiliser, weedkillers and certain poisons against soil parasites by means of the irrigation system.

Crop forecasting for the Citrusdal area

Temperature data for the period from flowering to the end of November are used to forecast the size of the navel crop for the Citrusdal area. The forecast for the 1979 crop proved to be 7,5 % higher than the actual crop. This deviation was investigated and it was found that the temperature had risen to as high as 41 °C on 1 December, although the rest of the month was not nearly as hot. When the effect of this single excessively hot day was taken into account it was found that the forecast only deviated 1,7 % from the actual crop size. A temperature of over 40 °C on a single day during this critical period in the development of the navel can therefore mean a crop loss of up to 6 %.

Plant nutrition

In a fertilising trial with Valencias at Citrusdal, various sources of N, P and K, applied by different methods, were compared. Each treatment was further divided into an application with lime and one without lime.

Liming proved to have a very good effect on yield, notwithstanding the fact that the pH was raised only from 4,1 to 5,0.

Calmaphos produced a good magnesium response, but potash magnesium did not have much value as an Mg source.

It would also appear that the monthly application of fertilisers is in no way better than the conventional 3 applications per year (July, December and March) in these excessively sandy soils.

Biological control of red scale

Red scale *Aonidiella aurantii* is being brought under complete biological control in more and more citrus orchards at Rustenburg, Marble Hall, Zebediela, Letaba, Letsitele and in the areas around Nelspruit and Malelane, i.e. in a total of 1 500 000 or more trees.

Red scale is resistant to organophosphates on many farms in the Transvaal Lowveld, with the result that farmers were obliged to change to an integrated spraying programme.

An integrated pest management spraying programme for the Lowveld was published after satisfactory results had been obtained in various experimental orchards over several seasons. The programme is based on the complete biological control of red scale, with certain selective sprays for pests and diseases for which chemical control measures are essential.

On one large citrus estate in the Northern Transvaal the annual cost of pesticides fell from R1-80 per tree a few years ago (with parathion used for red scale) to only 35 cents per tree (with no sprays for red scale, and with no pest repercussions).

Culling factors for red scale and other pests decreased when an integrated spraying programme was applied.

Ants

Ants are among the most numerous of all organisms. Some are beneficial and others harmful. For these reasons a comprehensive reference collection has been established so that all ants of citrus and subtropical fruit orchards may be identified. Disc electrophoresis has been used to distinguish morphologically similar species in the genus *Pheidole*.

Ecological studies are aimed at finding alternative measures to chemical control for combating noxious ants. Preliminary results indicate that establishment of an ant species complex obviates extensive dominance by a single pest species.

Citrus nematode

Previously the only remedy for severe replanting problems in citrus orchards was to pull up the trees and put the land under a less profitable crop, e.g. lucerne, for 6 to 9 years in order to reclaim the soil for citrus cultivation.

Since the registration of aldicarb and phenamiphos for the control of the citrus nematode *Tylenchulus semipenetrans*, which is largely responsible for the problem, citrus producers in the

Sundays River Valley have treated more than 100 000 young trees (one third of all non-bearing trees) and approximately 30 000 bearing trees.

Treated trees are now expected to reach the optimum production stage sooner and produce better crops. The rapid recovery of Eureka lemon on rough lemon rootstock has been dramatic.

The citrus nematode also causes a "slow decline" problem in established citrus orchards. If the critical ceiling level is set at 40 000 nematodes per 10 grams of feeder roots, recent surveys of 500 navel orchards, carried out with the co-operation of the Sundays River Citrus Co-operative, indicate that more than 90 % of the orchards require immediate treatment for nematodes. Further trials with phenamiphos are proceeding.

BANANAS

Storage

Because bananas are grown mainly for the local market, post-harvest research during the past few years has been aimed chiefly at problems that arise in the course of marketing bananas in South Africa. Good progress has been made with both the artificial ripening of the fruit and packing methods aimed at ensuring the even distribution of gases and the maintenance of even temperatures in ripening rooms.

The problem of collar rot in ripe bananas has been successfully solved by making a post-harvest treatment of the fruit with either benomyl or thiabendazole compulsory.

Phenology

Banana phenology studies have been completed at Burgers Hall. With Cavendish bananas, a marked seasonal periodicity of growth and fruiting was shown from 9 years' cumulative data.

With Williams bananas four cropping cycles were studied after a September planting date and seasonality was also marked in this variety. Thus, 75 % of all bunches were harvested from January to March and only 25 % during the nine months April to September. This has an important bearing on banana supplies and prices.

Williams banana is becoming more popular in most production areas, although the search for new mutants continues. Two of the most promising new selections have been planted at Burgers Hall in a comparative variety trial with Williams. Other selections have been imported from Central America, and some are reputed to be immune to Panama disease. These will also be tested horticulturally when released from quarantine.

In crop-timing studies with Cavendish it was found that November to February planting gave significantly better out-of-season crops at Burgers Hall, whereas at Levubu January planting was superior to planting in other months.

Pests

An experiment to control slugs which damage banana fruit was conducted at Tzaneen with different bunch coverings and various molluscicides. The results indicated that the use of transparent plastic bags could greatly reduce slug damage to bunches. Some burning occurred, but this can be avoided.

Pathological aspects

A new pathogen causing post-harvest decay was identified as a *Phytophthora* species and effective control measures were initiated in the packhouses concerned.

PINEAPPLES

Selection

The pineapple selection programme has progressed well during the past year, with 40 very promising clones having been reselected from approximately a thousand selected clones. The 40 clones are to be planted out for further re-evaluation and rapid propagation. Plants from the initial plant selection, started in 1957, have been made available to the pineapple industry.

Phenology

Satisfactory progress has been made with several phenology trials, such as natural flowering, artificial induction and plant development.

Spacing

Initial results from a spacing x planting material trial at Levubu indicate that Queen stumps planted in double rows have outyielded suckers planted at higher populations. Stumps planted in double rows have far outyielded stumps planted in single rows.

Leathery pocket

It has now been established that leathery pocket is primarily due to the fungus *Penicillium funiculosum* and that the mite *Steneotarsonemus ananas* plays a secondary role as a spore vector.

Mealybug

After trials directed at the control of mealybug on mature pineapples, three insecticides have been registered for pineapple mealybug control.

Plant growth regulators

The past two decades have seen the introduction into pineapple growing of a number of plant growth regulators. They are now being used extensively as a normal cultural practice.

Temperature

Temperature studies revealed that fruit temperatures ranged from 19 °C in the early morning to as much as 45 °C by midday on a day

when the maximum ambient temperature recorded was only 22 °C.

Experiments with polyethylene wax have proved that the dipping of fruit can reduce the moisture loss that occurs during exportation.

Other highlights during the year under review were the following:

- The registration of the first insecticides (3) ever to be registered for pineapple pest control in South Africa.
- The identification and evaluation of an insecticide which is far more toxic to soil beetle pests than aldrin and dieldrin, and which in field trials was second only to these two insecticides as regards residual control.
- The discovery of an important mite pest *Dolichotetranychus flordanus* of pineapples in Zululand.
- The discovery of three different Lepidoptera species, new to science and never previously described, in a pineapple field.

Soil erosion

The Department of Agricultural Technical Services has concerned itself lately with the alarming soil erosion experienced in pineapple plantations, since the advent of mechanisation, and has formulated guidelines for the prevention of erosion in the East London and Komga districts.

AVOCADOS

Graft incompatibility

A trial consisting of 19 different scions on 3 different rootstocks which is now 3 years old shows a definite deterioration in the condition of some combinations. Several combinations also appear to be developing stock or scion overgrowths, often correlated in the literature with graft incompatibility.

There is, however, as yet not enough information based on visual symptoms and growth measurements to draw firm conclusions, although those trees showing stock or scion overgrowths are in a poorer condition than those with normal unions.

Importation of budwood

In order to acquire stocks of various patented cultivars which may be of use as rootstocks, small quantities of Pinkerton and Santana were imported during 1979.

The presence of phytoalexins in avocado roots

The possibility of certain cultivars possessing phytoalexins in their roots, which could explain the tendency of some cultivars to be more resistant to *Phytophthora cinnamomi* root rot than others, is being investigated.

Preliminary results point to 6 compounds which suggest that fungi-toxic activity is present in

roots. The relative significance of these chemicals is being investigated.

Pathological aspects

Intensive research has culminated in the registration of two chemicals for the commercial control of *Phytophthora* root rot of field trees, and a new rapid technique has been developed for the vegetative reproduction of resistant rootstocks.

Entomological aspects

In the course of an investigation into the cause of certain knobs and spiny excrescences on the skin of Edranol avocados it was found that the untreated control fruit showed the same percentage of malformations as the fruit artificially stung by the Natal fruit fly early in the season. In the latter case the early stings heal completely and are not a factor at harvesting time.

Storage

Good progress has been made over the past few years in the field of post-harvest handling and storage of avocados. Since the avocado industry is geared largely to exports, researchers also concentrated on this aspect. Optimum storage temperatures, suitable packing materials and effective post-harvest fungicide treatments were found.

Major success was attained in the establishment of quality standards for export fruit and simple tests were developed. The most recent successes include the discovery of a correlation between the moisture content and maturity of the fruit, the development of a microwave oven test for determining the moisture content of fruit and the development of a fermometer for testing the ripeness of avocados. Seasonal influences on the keeping quality of avocados were also thoroughly researched.

MANGOES

Planting and selection

In an attempt to find more suitable cultivars for South African conditions, seedlings are planted for selection. About 2 000 seedlings were evaluated during the past year in order to find a promising selection. About 500 trees were eliminated that year, 25 possible selections were planted out and 100 Sensation seedlings were planted.

Graftwood was taken from the possible selections so that the trees could later be evaluated.

Of the new cultivars imported it appears that only Tommy Atkins is sufficiently promising to be added to the list of cultivars.

Pruning

Of the pruning treatments applied to boost the crop obtained from trees that are starting to touch, a hedge pruning system with a north/south espacement of 4,57 x 9,14 m produced the best results.

Determination of ripeness

In the course of trials carried out to determine the earliest possible harvesting date for mangoes that are physiologically mature, it was found that mangoes can easily be sent to distant markets while still retaining their colour and flavour, and with no jelly seed development.

In the absence of any external colouring Sensation can be picked when 15 % of the fruit sinks or rises slowly in water at 25 °C and with 10 % internal colouring. The harvesting period is then 18 days. It was found that fruit of the cultivar Zill is picking ripe when 15 % of the fruit sinks or rises slowly in water at 25 °C, with 20 % internal colouring. The harvesting period is then 17 days and the fruit takes 14 days to colour fully.

The Haden cultivar contains more fibres. It was established that although between 50 % and 80 % of the fruit sank in water at 25 °C, only 5 % internal colour was present. But after 14 days' storage 90 % to 100 % internal and 80 % external colour had developed. The results obtained with the Peach cultivar varied greatly. Internal colouring was slow after 53 % of the fruit had sunk at 25 °C; internal colour developed after 14 days at the expense of the external colour.

Plant nutrition

A fertilising trial with the Zill cultivar is being carried out in the Komatipoort area with the purpose of determining the effect of NPK on yield and leaf composition.

Increased N levels tend to reduce the yield and produce smaller fruit. Applications of phosphate raised the yield significantly and increased the number of fruit per tree. Potassium did not appear to have much effect. Leaf samples were taken during September and November and both samples reflect the effect of the N and K levels in their composition. Phosphate showed no effect on leaf composition, however, which confirms previous findings that leaf analysis is not a suitable method for determining the P status of a mango tree.

It would appear, however, that leaf samples taken as early as September would be suitable for purposes of analysis. This early sampling would give the farmer more time to adjust his fertilising programme.

Storage

During the past decade the mango industry has grown from a relatively insignificant industry to potentially one of the largest exporters of subtropical fruit. Over a million trees are expected to be in production this season.

Research on post-harvest problems has had to keep pace with this expansion : excellent progress has been made. By applying optimum storage temperatures, suitable packing methods and effective hot fungicide treatments, post-harvest spoilage in mangoes shipped to overseas markets has been reduced to perfectly acceptable levels.

Irradiating the fruit has been found to render the mango weevil inactive and even extend the shelf life of the fruit in certain cases.

PAWPAWS

Storage

The pawpaw industry has only recently started exporting on an appreciable scale. However, research programmes over the past few years have made provision for exporting and most of the post-harvest problems have already been solved. Suitable transportation temperatures and packing materials have already been found. A suitable post-harvest fungicide treatment has also been developed during the past season and an application has already been submitted for the registration of this treatment.

LITCHIS

The litchi industry in South Africa is still developing on a sound basis. Increases in production are in line with the market potential. In the Republic the litchi industry is founded on a single cultivar, namely the H.L.H. Mauritius. Because it is necessary to extend the litchi season through the use of various selections, a selection programme has been started. Eight selections, from about 430 trees, have so far been made. These selections are being compared with each other and with the commercial cultivars. The project in which air-layered trees are compared with grafted trees has been completed, and it appears from the root studies that the grafted trees have a better developed, deep tap root system than the air-layered trees. With regard to the yield, the one method has shown no particular advantages in comparison with the other over a number of years.

Fertilising

Whereas the effect of phosphorus on the production of these 12 year-old trees has been very slight in the past, a very marked response is now being obtained. This major increase in yield is characterised by the strong interaction between nitrogen and phosphorus applications. The application of nitrogen, in the absence of phosphorus, had a quadratic effect on production in that the high N level had a suppressive effect. The production in kg/tree of the 3 N levels was 27,4; 56,9 and 32,1. Where phosphorus was applied, however, nitrogen produced a linear increase in production, namely 25,8, 41,8 and 78,1 kg/tree. Therefore, although phosphorus does not initially limit production, it becomes very important after 12 years if large amounts of N are applied. On the other hand, phosphorus applications at the lower N level can suppress production considerably, namely 56,9, 49,7 and 33,9 kg/tree, respectively, for the three levels of P.

It is therefore extremely important that the correct balance between N and P be maintained.

Storage

Owing to the extremely favourable prices this fruit fetches overseas, and the fact that litchis are highly perishable when stored, it was usual until recently to export this fruit by air. However, research on this fruit has been geared to the possibility of sea transport for a number of years. Considerable success has been attained. Optimum storage temperatures have been determined and suitable packing materials and methods for exporting by sea found.

During the past few seasons there has also been good progress with the control of post-harvest fungi in litchis. A combination of fungicides applied hot produces very good control of post-harvest fungal growth on litchis exported by sea. This should reduce export costs considerably.

GUAVAS

Considerable interest has been shown in the guava industry, particularly in the fields of juice extraction, drying, canning and exporting fresh fruit.

The selection programme is proceeding and a further 1 000 trees are ready for transplanting. At present there are five selections that are continuing to show promise.

A preliminary finding from pruning trials at Levubu is that October is the best time to prune. The trials also indicate that the longer pruning is postponed after October the greater the reduction in the crop. Various pruning systems are also being compared.

KIWI FRUIT

It was determined in the course of a grafting trial with kiwi fruit that young kiwi fruit seedlings can be grafted during the growing season from August to December using graftwood cut during the dormant season and stored at 4 °C.

Graftwood from the current season that has already hardened off may be used for immediate grafting from January to March, but should not be stored for a long period.

MACADAMIA

Macadamia nut crops are increasing by the year and no new selections have been made. Progress has been made with marketing the crop, and this aspect is receiving the full attention of the industry at present.

PECAN NUTS

The production of pecan nuts is still increasing. The cultivar Choctaw again showed susceptibility to scab, which is why it is increasingly being replaced by Moore.

Two new cultivars were imported from the USA this year, namely Melrose and Cape Fear. According to the data, the cultivar Melrose is resistant to scab and produces a good crop of large nuts. Cape Fear bears very well, but is not resistant

to scab. Scab can, however, be controlled by spraying.

TEA

Vegetatively propagated clones

Some 245 plants of 16 clones were collected from a Sapekoe estate in February this year. The plants were taken from Tzaneen to the Burgers Hall Experimental Station, where they were planted out ten days later. Since planting, irrigation has been applied and the first application of LAN was given in March. The plants are all looking very well.

The object of obtaining and planting these clones is to multiply them by vegetative propagation and to evaluate them in the CSFRI's mini-factory (due for construction this year) in the search for a clone or clones suitable for the various tea-growing areas of South Africa.

Multiplication of CSFRI selections at Burgers Hall

Of the 13 selected clones 3 more have been eliminated, so that only 10 are now available for multiplication, testing and evaluation. To date 260 cuttings from 5 selections have been planted. The rooting medium used is the conventional, low pH subsoil. Single superphosphate fertiliser is mixed with the soil in the ratio of 1,35 g:1 kg of soil.

Because the number of cuttings from each clone is small, the cuttings are not rooted in an ordinary vapour tent consisting of a plastic sheet draped over a frame. Instead, empty fertiliser pockets pulled over a frame of 8-gauge wire are being used. The pockets are thoroughly washed out with water beforehand. Because of the limited size of the small vapour tents, only single-leaf cuttings are planted.

The object is to multiply these selections so that they eventually yield leaves in quantities large enough for testing and evaluation in the mini-factory.

COFFEE

A trial to determine the yields obtained with various plant populations was started. The trial consists of 6 different planting densities, namely 7 200, 6 000, 5 400, 4 000, 3 000 and 1 600 plants per ha. Five different cultivars are being compared in the trial, namely Blue Mountain, Caturra, SL 28, SL 34 and Robusta.

GINGER

Fourteen different ginger strains were compared. Eight of these strains were found to be good enough for commercial cultivation for purposes such as canning, the production of ginger oil, the fresh market and the production of dried ginger for the spice market.

Four imported ginger strains are still under quarantine and will be available for comparative tests later.

PEPPER

The new trellising system with three poles per plant position and a height of 4 metres appears very promising. The first crop from the three year-old plants is expected during the coming year.

TURMERIC

Plant material was visually selected to find the best for commercial cultivation. "Fingers" and "tubers" were compared as plant material and it was found that "tubers" produced the highest yields.

BIXA

Satisfactory progress has been made with a study of the fruit development of *Bixa orellana* (L), also known as the "lipstick tree". Of all the climatic factors, temperature has the greatest effect on the development and opening of the flower, the rate of pollen tube growth in the style and the further development of the fruit. Research is continuing.

CHEMICAL SERVICES

Analyses

The total number of soil and leaf samples analysed by the analytical laboratory of the CSFRI, namely 7 879, remained fairly constant in comparison with the number analysed during the previous year, namely 7 804. Samples received from producers seeking advice on fertilising again increased, however. Leaf samples increased by over 28 % - from 1 400 to 1 800 and soil samples from 1 638 to 1 672.

Fertilising costs

There was a further sharp increase in the price of fertiliser at the beginning of 1980. The increase amounted to 16,9 % for nitrogen, 12 % for phosphorus and 31 % for potassium. Because bananas and pineapples require large amounts of nitrogen and potassium, expenditure on fertilisers for these fruits has increased a great deal. The cost *per hectare* of an average fertilising programme would be approximately as follows:

	1978	1979	1980
Pineapples	R251-22	R285-50	R354-25
Bananas	R200-38	R228-28	R275-31

These major increases underline the importance of optimum fertilising, i.e. applying fertiliser only in the quantities and of the kinds required for a particular crop on a particular soil. Optimum fertilising is possible only with the aid of soil and leaf analyses.

FLOWERS AND ORNAMENTALS

ROSES

Cultivar-rootstock trials with roses

The cut rose industry in South Africa has made enormous progress during the last few years. There is a great deal of scope for production and exporting, but a lack of the necessary knowledge is hampering development.

Methods of boosting production have become extremely important in the industry. The Horticultural Research Institute has found that cultivar-rootstock compatibility plays an important part in flower production. In an investigation with a combination of seven rose cultivars and rootstocks it was found that some have an effect on flower production and, to a lesser extent, on production peaks as well. It is therefore possible to determine the best rootstock(s) for a specific cultivar. In some cases this can even double production. The results show that the best rootstocks for the various cultivars are the following:

Eclipse	- Welch, Atwood and Basye 3
Carina	- Basye 3, Welch and Clarke 1952
Exciting	- Basye 3, Brooks 1948 and Prinshof 2
Happiness	- Basye 3, Welch and <i>Rosa manettii</i>
Mandrina	- Welch, Prinshof 2 and Clarke 1952
Pascali	- Prinshof 2, Brooks 1948 and Welch
Queen Elizabeth	- Basye 3, Prinshof 2 and Atwood

It is intended to carry out further trials with new rose cultivars in order to determine the best cultivar-rootstock combinations.

Post-harvesting physiological studies with roses

The relatively short vase life of cut roses is one of the biggest problems facing the cut rose industry. The rose has always been regarded as the "queen of flowers", but as a result of its poor keeping quality the popularity of the rose has declined.

The Horticultural Research Institute has found, however, that the vase life of roses can be more than doubled by correct handling and the use of a flower preservative.

It was found that roses should be cut when the sepals open. The roses should then be placed in

A vigorous Kiwi-berry plant that was grown in a planting bag. There were no problems with lodging disease



The large-scale multiplication of *Ornithogalum* flowers by means of tissue culture. (This is done in test tubes but the parts of the plants and the seedlings were removed for illustration purposes.) 1 shows the piece of leaf which is placed on the growth medium; 2 shows callus growth and the first plants that develop on a piece of leaf; 3 is a number of plants growing from the piece of leaf; 4, plants are then broken off and planted individually or in small parts in a tube containing root hormones in the medium; and 5, plants with roots ready for transplanting to soil

The new white-seeded green bean cultivar Rolito with its attractive, straight pods. Rolito was released with a view to exports of young green beans



a cold-room as soon as possible in order to dispel the heat of the field.

With regard to post-harvesting treatment by the consumer, a preservative has been developed which is added to the water in the vase. This preservative consists of 2,5 mg of silver nitrate + 130 mg of 8-hydroxyquinoline sulphate + 200 mg of citric acid + 30 g of sucrose per litre. Researchers are now working on a pre-treatment that can be used by the producer, which would be a more effective method of treatment than leaving the use of the preservative to the consumer.

ORNITHOGALUMS

In an attempt to speed up the multiplication of the *Ornithogalum* breeding strains that are to be released as new cultivars, so that the industry can obtain sufficient bulbs to start production on a sizeable scale, a tissue culture multiplication technique was developed for this plant. It was found that leaf tissue is the best for tissue culture because there is far less infection than when material is taken from bulb scales and because it propagates far more easily than material taken from other organs.

It was found that with the tissue culture method about 10 000 rooted plants can be grown from one leaf within about 8 months. The six new cultivars which are to be released are being multiplied rapidly in this way at the Horticultural Research Institute. A further advantage of the tissue culture technique is that the plant does not become dormant in summer, as is usually the case with this crop. Consequently the bulbs grow to their full size in the space of a year and some even bloom as well.

While the *Ornithogalum* cultivars are being multiplied by the tissue culture method, they undergo continuous testing for viruses. All the material multiplied in this way so far has tested negative for virus infection.

PROTEAS

During the past season there has been a significant drop in the rate of growth in the protea cut flower industry. The decrease may be ascribed partly to a severe shortage of available air freight space experienced during the middle of the summer (festive season). There was an unprecedented oversupply of pincushions during spring.

The severe shortage of available air freight space necessitated a re-evaluation of sea transport for refrigerated proteas. An investigation using improved containers for sea transport and methods of physiological conditioning ("pulsing") of cut proteas to extend their post-harvest life was started.

The first pincushion crossings, which were carried out in 1975, were evaluated this year. The flowering and growth properties of the crossings were very good, showing that there is a prospect that the industry may later use interspecies crossings on a large scale.

Simplified and improved methods of rooting were finally evaluated. A cheaper and more

practical rooting frame was developed, as was a method of rooting cuttings directly in containers, which makes hardening off easier. This method could promote the general use of selected material through the rooting of cuttings.

Promising results were obtained in the course of feeding trials carried out by the University of Pretoria during a contract research project. As a result it will be possible to start fertilising trials with proteas during the coming season. It is apparent from the results that most protea species are very sensitive to phosphate fertilising, and to nitrates as a source of nitrogen. Ammonia is clearly a better source of nitrogen.

FLOWERING BULBS

Breeding

The South African flowering bulb industry has shown very steady growth during the past decade. Since 1970, especially, exports of cut flowers and flowering bulbs have increased a great deal. During 1978 and 1979, 80,7 million winter bulbs and 2,9 million summer bulbs were exported. These numbers were made up as follows:

17 million ornithogalums, 2½ million sparaxis,
1 million tritonias, 1 million freesias and half a million babianas.

These varieties are all indigenous to South Africa. The indigenous flowering bulbs constituted 26,2 per cent of all the flowering bulbs exported. Except for freesias, which were bred overseas, the other varieties are mainly selections of the pure species that occur in nature.

In order to stimulate the flowering bulb industry, a breeding programme aimed at exploiting the potential of indigenous South African flowers was started at Roodeplaat.

In 1966 the breeding of lachenalias was started. This breeding programme has expanded rapidly since 1973 and the results obtained appear very promising. Plant breeders' rights have been applied for five outstanding selections. These selections will probably be released to the industry by the end of 1981.

During 1975 an ornithogalum breeding programme was taken over from Professor R. de V. Pienaar of the University of Stellenbosch. From this material one plant was selected for release. This selection has a good stem length and bears white flowers with a black heart. Excellent selections with yellow flowers were obtained by further breeding. These selections all have long inflorescences and produce three or four stems per plant, in contrast with the two stems per plant of the present commercial types. Four of these selections are now being multiplied, by means of tissue culture, for release. A further selection which has been multiplied has white flowers and very long inflorescences - twice as long on average as those of the present cultivars. The multiplication of all these selections is so far advanced that they will probably be released as cultivars towards the end of 1980.

Zantedeschia

The study of the disease that causes deformities of the leaves and flowers of *Zantedeschia* spp. is proceeding. Electron microscopy studies show that affected tissue may possibly contain two viruses related to potato virus Y. It appears that the virus may possibly be the dasheen mosaic virus which attacks plants of the *Colocasia* spp. (dasheen and taro), *inter alia*.

Browallia speciosa

This species, which is available with flowers ranging from white to various shades of blue, has been found to be a very useful flowering pot plant. It can be grown either from seed or from cuttings. Grown in the glasshouse at a day temperature of 25 °C and a night temperature of 12 °C, plants that flower profusely can be produced throughout the year.

A soil drench consisting of 0,25 mg of ancymidol (A-Rest) in 50 ml of water applied to a 120 mm pot has been found to keep the plants compact, with a desirable shape for an attractive pot plant.

Kept in a well-lighted position under household conditions the plants continue to flower well for at least three to four weeks. Without a growth retardant treatment the plants are also useful for hanging baskets.

INDIGENOUS PLANTS

Plectranthus ekloni, which bears large spikes of purple flowers, appears to have potential as a pot plant. It roots very easily from cuttings and can be propagated directly in the potting compost in the pots used for the flowering plants. Flowering can be induced by a short day treatment of a 10 hr day and the reaction time is about 8 weeks. The flowering plants stand up well to indoor conditions, if not overwatered.

Plectranthus barbatus has been found to make an attractive foliage plant. Cuttings root readily in the potting medium. The foliage is variegated, with an unusual pastel green colour. The plants remain in good condition for a considerable period if they are dwarfed, using a soil drench treatment with either 0,25 mg of ancymidol or 200 mg of Cycocel in 50 ml of water for a 120 mm diameter pot.

Ruttya fructuosa is another indigenous plant which shows promise as a flowering pot plant. It bears unusual orange flowers. Cuttings root readily and if the young plants are suitably pruned a compact plant with numerous flowers can be obtained. Treatment with growth retardants is used to improve the leaf colour.

Hypoestes aristata continues to attract world-wide interest as a flowering pot plant and material of varieties of different colours has been supplied to Australia, Canada, Germany, France and the USA.

VEGETABLES

TOMATOES

Breeding

A tomato breeding project is being carried out at Nelspruit, Roodeplaat and Elsenburg. The programme for the development of cultivars resistant to kromnek virus is progressing well at Elsenburg. Three resistant table tomato strains that qualify for release in respect of quality and fruit size have been selected during the past year. They are now undergoing final evaluation on the farms of two co-operative collaborators, mainly to determine how acceptable they would be to the producer and the consumer.

One processing strain that is resistant to kromnek, has good canning qualities and yields well has also been selected. The shape of the fruit is poor, but this should not be a problem in tomatoes used for the preparation of pasta. The selection will undergo final evaluation and processing next year in the most important areas where kromnek is a major problem.

Of the hundreds of breeding strains developed in the programme at Nelspruit, the following two market and three canning tomatoes which are being prepared for release may be singled out:

With regard to market tomatoes, breeding strain L71/299 breeds pure and is highly resistant to bacterial wilt. It has an indeterminate growth habit, grows luxuriantly and has a characteristic dark green leaf colour. It possesses the same fruit quality as one parent, Heinz 1370.

The other breeding strain, L52/299, breeds virtually pure and is about 65 % resistant to bacterial wilt. It is more compact and more determinate than one of its parents, viz. Flora-Dade. The fruit is particularly firm and is virtually without defects such as catface and cracking.

Of the factory tomatoes, the breeding strain L315/304 is just as resistant to bacterial wilt as one parent, viz. L2024. The fruit is just as firm as that of the second parent, H4023, and is very well adapted in the Lowveld. The breeding strain L23/172 may be regarded as a nematode-resistant Castlong. Its general growth habit and resistance to disease are better than those of Castlong.

Breeding strain L45/317-1-1-A already breeds pure. Although it is not resistant to nematodes or bacterial wilt, it is very well adapted in the Lowveld and produces high yields. The fruit is large and rectangular, has a good internal and external colour and is very firm.

Of the large number of market tomato breeding strains evaluated at Roodeplaat, the series LR 45/315 produced the best yields and quality. In extremely unfavourable conditions it was possible to select very strictly against leaf diseases and for fruit quality.

In the factory tomato programme at Roodeplaat the emphasis was placed on resistance to nematodes. A combination breeding programme is being followed in which a resistant parent is

crossed with a commercially acceptable cultivar. The progeny are then planted in the field and allowed to self-pollinate. From the second generation onwards as many selections as is practicable are made and tested for resistance. Every six months 60 breeding strains are tested for resistance to nematodes and work on the resistant strains is continued.

In a further evaluation of advanced factory tomatoes many breeding strains produced better yields than the standard Roma V.F. and Rossol. The following strains were outstanding in respect of yield and quality: *three* strains in the series L45/315(ES58 x P4023); *three* in the series LR 319/315 (P223-E73 x P4023) and *one* WP 207 selection.

Protected cultivation

Protected cultivation is passing through a period in which methods are changing and consolidation is taking place but stagnation is also present. The major interest and expansion of a few years ago have decreased considerably and alternative crops are being investigated. There are two reasons, namely economic considerations and the build-up of diseases.

The main aim of the research on tomatoes at Elsenburg is the development of a cultivar that is resistant to krommek. Because all cultivars have to be imported (which is very expensive) and the best are all F1 hybrids, a small breeding programme was launched at Roodeplaat with the aim of developing a suitable open-pollinated cultivar. Very good progress has been made with this programme and twelve strains have been selected for final evaluation and purification. The best of these strains have a production potential of as much as 190 tons per ha.

A high potassium status in the soil is recommended by several researchers. The effect was investigated in two tunnels - one with solar heating and the other unheated. The results showed that with a high potassium status of 350 ppm and solar heating the yield was 30 tons per ha higher than that obtained from the control, which had a potassium status of 130 ppm. No differences in fruit firmness and seed set were found. At the lower potassium level the fruit was 12 g smaller on average and more hollow fruit occurred.

In the unheated tunnel there were *no* differences in yield and fruit quality with the high and the low potassium status.

Diseases

(1) *Verticillium* wilt

Field trials have shown that if the root system of tomato plants is disturbed during transplanting, infection with *Verticillium dahliae* can considerably reduce the stand of plants and consequently also their production. When transplanting shock is kept to a minimum, *V. dahliae* does reduce the production of the plants but not the stand. Under field conditions the stage of growth of the plants at infection had no significant effect on the disease.

(2) **Bacterial canker** *Corynebacterium michiganense*

It was found in the course of a field trial that the yield of lesion-free fruit obtained from tomatoes that were inoculated with an average of 2,2 cells of bacterial canker *C. michiganense* at the early seedling stage, i.e. immediately before transplanting, was up to 85 % less than that obtained from the untreated control.

GREEN BEANS

The green bean breeding strain 265/61-3-1, which is resistant to halo blight, was released during March 1980 as a new cultivar under the name of Rolito. It has attractive, straight, stringless, pencil-thick pods with a good keeping quality. Rolito is suitable for fresh marketing, specifically for packing for export purposes, as well as for the local supermarkets. For optimum pod shape and quality it is essential that Rolito's pods should be picked at the correct stage and the correct seed size. When the pods are cut open the seeds should still be very small. The maximum permissible seed size in the green pods is 5 mm.

The value of Rolito lies in the fact that it meets a need for a stringless cultivar that is highly tolerant of the major bacterial disease, halo blight *Pseudomonas phaseolicola*, which causes major crop losses from time to time.

A new range of green bean breeding strains has reached the testing stage and selections of the large-podded dwarf-bean breeding strains (181/64)/191 have made an extremely good showing. They have straight, fairly long pods of good quality and colour; the growth habit and habit of bearing are suitable for mechanical harvesting. These selections show extremely high tolerance of halo blight and regularly produce very high yields.

Cultivars

The cultivar Cape has started to become very prominent in the processing industry. It possesses very good qualities on the whole, but has only moderate to poor resistance to halo blight, so that problems may arise when conditions are favourable for the pathogen, especially when the cultivar is planted in the summer rainfall area during early summer.

MUSKMELONS

Final purification and evaluation of the most promising breeding strains have been completed at Elsenburg. A White Elche type, which is not subject to sunburn and is suitable for shipping, has been developed. Market research to determine its acceptability will be carried out during the coming season.

Progress has also been made with the breeding of the cultivars Honey Dew and Green Elche, which are exported by sea at present. Researchers are trying to produce a cultivar which yields well, and has a fruit shape which is true-to-type and good storage and eating qualities.

In the course of yield trials held in co-operation with the Fruit and the Fruit Technology Research Institute it was found that the optimum temperature is between 15 and 18 °C.

Cultural trials with some of the best cultivars and a few breeding strains from Elsenburg were continued at Addo and Roodeplaat.

Three of the breeding strains produced the highest marketable yield at Addo. Not only do they have an outstanding yield potential, but they are also highly resistant to sunburn and fruit cracking in that hot area. Saticoy was the best of the recognised cultivars.

At Roodeplaat the breeding strains formed an excellent crop, which was, however, destroyed by *Fusarium* root disease before it was ready for harvesting. The early cultivar Classic, Dixie Jumbo and Saticoy performed best here.

PUMPKINS AND SQUASHES

A flat, white Boer pumpkin selection *Cucurbita maxima*, which has a thin layer of green tissue under the skin, was planted in isolation for seed multiplication and the determination of purity and yield. Relatively big variations in fruit shape did nevertheless occur. Further inbreeding was therefore carried out and these strains will undergo further investigation before breeders' seed is made available. Four field-pumpkin strains *Cucurbita moschata* were planted in isolation for the determination of purity and for seed multiplication. The variation was still too great, however, and the strains will be investigated again after further inbreeding. One very promising strain (S 103/2) with a dull yellow skin colour and large watermelon-shaped fruit was ready for planting in isolation. The fruit has thick flesh, with a deep orange colour and a small seed cavity, and is very resistant to sunburn and cracking. The plot produced a high yield of 59 t/ha.

Two of the three strains (58/1 and K 58/3) selected from the indigenous pumpkin *Cucurbita maxima* from Caprivi have already bred very pure and will be grown in isolation for the determination of purity and for seed multiplication. Seed of self-pollinating fruit of selection K58/2, which bred less pure, will also be multiplied and investigated because this strain produced the highest yield of the three (17 t/ha as against 14 t from K58/3 and 13 t from K58/1). The plants of all three selections are very resistant to leaf diseases and the quality of the young fruit is very good.

Seventeen squash strains *C. pepo* were bred for resistance to mosaic, using the crossing Rolet and the strain 176959, which originated in Turkey and is resistant to cucumber mosaic. However, these 17 strains are not resistant to watermelon mosaic virus. Because six of these breeding strains produced high yields, however, they are undergoing further investigation.

PEAS

Green peas

The demand for freezer peas is still growing and during 1978/79 almost twice as many freezer types (11 735 tons) as canning peas (7 834 tons) were produced. Hail, frost damage, drought, empty irrigation dams in the Loskop area and flood damage in the Southern Cape areas reduced the yield during the past year. In order to stabilise production, manufacturers are making continuous attempts to expand to other production areas.

A very successful planting was carried out in the Lowveld during the months of March and April of the past year.

The breeding programme was continued at Roodeplaat and Outeniqua with the aim of developing better adapted cultivars. The crossings and selections at Roodeplaat now number 221 and those at Outeniqua 450. *Ascochyta* sp. and *Mycosphaerella pinodes* remain the most important problems in the Southern Cape. Genetic material with resistance to these diseases has been found and will be incorporated in the programme as soon as possible.

Of all the breeding strains evaluated, strain 1102-1 performed best and should be ready for release to the industry by 1981. The programme includes work on the development of vigorous growers that are adapted to late summer planting. High air and soil temperatures - up to 33 and 37 °C respectively - cause growth and germination problems with the usual cultivars.

Dried peas

The balance between the supply and demand of green and yellow dried peas still appears to be creating a problem for the industry. There are no valid reasons for importing any dried peas for consumption. The pea programme includes work on the selection, evaluation and manipulation of dried peas. Cultivars such as Birte, Satellite, Rondo and All Round are available; they all bear good crops of high quality peas and are well adapted. The late summer plantings of Black Eyed Susan appear promising and could be harvested during the dry winter months.

CAULIFLOWER

A few good breeding strains were developed from a crossing made between the excellent late cultivar Snowcap and an extremely early breeding strain developed at Roodeplaat. The best of these, 78/124, has a fairly rapid development period of 57 to 90 days after transplanting. This breeding strain has a characteristic growth habit; it has long, erect foliage leaves that form a sharp contrast to the short, small leaves that fold neatly around the heads to form a fairly good head cover. The heads are very firm, with a good quality. The breeding strain is highly resistant to bacterial black rot.

Cultivars

On the basis of trials carried out at Roodeplaats during the past few years, the following cultivars are recommended for growing in the Transvaal Middleveld at present:

Early - Snowcrown

Early midseason - Igea 65 and Snow Diana

Midseason - Snowball

Late - Snowcap and Early Italian Giant

There is also a need for good early and midseason cultivars in the Western and Southern Cape. In the evaluation trials at Elsenburg the two cultivars Snow March and Snow King performed best and produced a high yield of good quality. The first heads of the latter were ready for harvesting within 48 days when sown in January.

For freezing the factories require a cultivar that remains firm and white after blanching. Snowcap meets these requirements. The biggest drawback of this cultivar is its extended growing season of five months or more.

ONIONS

Breeding, which took the form of inbreeding, was continued at Roodeplaats during the past year in order to promote the development of a pure and stable brown round-bulbed cultivar for the areas with short days. Good progress was made with the breeding strain 322, which is being released under the name of Hercules, with Early Premium and with the breeding strain Creole 5. Bolting and split bulbs have been virtually totally eliminated and uniformity in bulb shape increased.

With regard to white onions for dehydration, the same procedure was followed with the various Dehydrator types. At Roodeplaats success was achieved only with Dehydrator 8. At Nelspruit good progress was made with Dehydrator 3, which still causes many problems in the Lowveld.

The Elsenburg breeding programme for the improvement of Australian Brown and Caledon Globe has made such good progress that it will be possible to subject seven good Caledon Globe strains and one Australian Brown strain to co-operative testing with a view to releasing the best strain. These strains are all more uniform than the commercial samples and have an extremely attractive brown colour. Inbreeding of these cultivars should be undertaken cautiously since it affects growth vigour very adversely.

Cultivation and evaluation

The search for white dehydrator cultivars that are better than the existing cultivars is being continued at Roodeplaats and Elsenburg. New material is being widely sought for this purpose and locally evaluated. In a cultivar trial of this kind involving 8 cultivars at Roodeplaats, two entries from Israel, namely White Haemek and No. 86, performed best. The former also had a very high solids content of 17,2%, which is essential for dehydration. No. 86 had a solids content of 15,6%. The dehydrator types and White Creole had an

equally good or even slightly better solids content, but their adaptation, and consequently their yield, in the Middleveld is extremely poor. All these samples were dehydrated by the CSIR and evaluated.

A similar trial was carried out at Elsenburg with 10 cultivars and six sowing times. The samples were dehydrated and evaluated by the FFTRI. It appears from the results that Dehydrator 14 and Dehyso performed best and that sowing should be carried out in May in the Western Cape. The other Dehydrator types, White Creole and Creoso, produced excellent dry products, but their fresh yield was too low, as in the past, in comparison with yields obtained from Dehydrator 14 and Dehyso.

At Glen eight of the best brown short and long day cultivars were tested in a trial with direct sowing and transplanting at an optimum planting time. All the cultivars produced 34 tons/ha or more after transplanting, with Bon Accord and Hojem producing the highest yields, namely 42,6 and 47,8 tons/ha respectively.

Australian Brown and Pukekhoe also produced good yields, but produced 28,3 % and 22,8 % thick necks and 4,4 % and 4,8 % split bulbs, respectively.

Slightly higher yields were obtained with direct sowing, but the percentage of thick necks and split bulbs was also slightly higher. The bulbs were slightly larger on average with direct sowing.

SWEET POTATOES

A large number of seedlings from the breeding programme at Roodeplaats are being evaluated, mainly with the purpose of developing cultivars that are adapted throughout the country and store well in the soil. The crossing programme revealed crossing incompatibility between Kenya and Impala, a problem which will now be specially investigated. Kenya is a cultivar of unknown origin that possesses exceptional colour, quality and keeping quality, but produces a poor crop. Impala, on the other hand, possesses equally good colour and quality and bears an excellent crop, but the keeping quality is poor. Crossings between the two cultivars should produce good results.

At Nelspruit one good breeding strain, E75/8, was selected. It has a red skin and is very well adapted in the Lowveld. The release of the strain should be considered shortly.

It was established in the course of evaluation and cultivation projects that Ribbok is very well adapted in the Western Cape. It produces excellent crops and is popular with both the producer and the consumer. It sprouts more easily than Kudu and as a result it may possibly replace Kudu in time for ridge production.

Griqua, which is very well adapted in the Western Cape, now appears to be more susceptible than the other cultivars to the disease ashy stem blight, which is caused by the fungus *Macrophomina phaseolina*.

It was established in preliminary trials at Roodeplaats that Steenbok and Ribbok are ready to

produce a marketable tuber sooner than the other cultivars. Three-and-a-half months after planting these cultivars produced 16 tons/ha. After four months, however, Impala and Ribbok outdid all the others, producing 40 tons/ha.

Trials in connection with the overwintering and production of sweet potatoes and potato vines in the Free State were continued at Glen. Five of the best known cultivars were left in the soil under transparent plastic for four months of the winter after harvesting (end of April). When they were lifted on 5 September, no sponginess was observed in any of the cultivars. Brondal and Kudu showed the best keeping quality and produced 40 and 34 tons/ha respectively. Impala showed more rotting than any of the others.

Brondal and Kudu tubers, wintered in the soil in vine production trials at Glen, produced twice as many vines per ha (1 million as against $\frac{1}{2}$ million) than the other cultivars by 1 November. This is of importance in the Free State, where planting should take place early in summer.

All the best known cultivars and the best breeding strains were subjected to chemical analysis by the CSIR. Of 13 cultivars and five breeding strains the well-known Sesmaande Wit had the highest carbohydrate content (36,3 %), followed by Mafutha and breeding strain 73-10-37 in the second place, with 28,2 % each. Breeding strain 73-1-107, with a content of 13,7 %, was the lowest. With regard to protein, Sesmaande Wit was also in the lead, with a content of 3,3 %. Breeding strain 76-9-2, with a protein content of 1,9 %, was the closest. The protein contents of the rest all lay between 0,9 and 1,7 %. It therefore appears that Sesmaande Wit can fruitfully be incorporated in the breeding programme.

GARLIC

All the local samples of garlic collected throughout the country were found to be infected with a rod-shaped virus when examined under the electron microscope.

Scales of the bulbs were repeatedly subcultured on tissue culture. This resulted in a significant reduction in the virus content. A few plants grown are still testing negative for virus infection. The plants will be grown for another few generations and examined for viruses in an attempt to produce virus-free material locally.

Diseased garlic plants from the Northern Transvaal were found to be infected with *Fusarium* spp. in the bulbs and *Stemphylium* sp. on the scales.

ASPARAGUS

The Eastern Free State is rapidly developing into the most important asparagus cultivation area. There are already three factories in the area that can asparagus and a further two are shortly to be erected. The area clearly produces very high quality asparagus on dry land, provided that the correct soil is chosen. Asparagus soil should contain sand with a very low clay content and should be about 1

metre deep. Where soils are shallower and contain too high a percentage of clay, drainage problems arise and the asparagus becomes very susceptible to *Fusarium* infection. Clearly the relatively cool soils of the area in early summer are eminently suited to the production of high quality asparagus.

PROPAGATING MATERIAL

Roses

The selected grower under the Rose Plant Improvement Scheme established his parent block of rose rootstocks this year. He planted 28 rose rootstock cultivars. The total planting comprises 20 400 plants. The grower ought to come into production during 1981 and will then supply all the rootstock material to the industry.

As an interim measure the Horticultural Research Institute again supplied the necessary rootstock material to the industry during 1979. A total of 132 000 rootstock shoots were issued to the industry.

A total of 147 new rose cultivars received by the Horticultural Research Institute were topworked to their indicator rootstocks.

The cultivars will be evaluated during the coming season.

Sweet potatoes

In all 278 000 virus-indexed potato vines were supplied to the approved potato growers under the Scheme. Of this number the cultivar Brondal accounted for 110 000 vines and Steenbok, the new cultivar, for 55 000.

Strawberries

The "A"-growers under the Strawberry Plant Improvement Scheme were supplied with 6 060 daughter plants. The biggest demand was for Selekt and Parfaite.

PLANT AND SEED CONTROL

INSPECTION SERVICES

CONTROL OVER THE SEED TRADE

Registration of cleaners and sellers of seed

At present there are 84 and 339 registered cleaners and sellers of seed, respectively, in South Africa, which is a total of 423 as against 400 the previous year.

These registered cleaners and sellers of seed are distributed over the four provinces as shown in Table 1.

TABLE 1

	Transvaal	Cape	Natal	OFS	Total
Cleaners	41	23	8	12	84
Sellers	135	120	48	36	339
Total	176	143	56	48	423

Control over the cleaning and sale of seed

A total of 810 seed distribution points were visited and 1377 inspections were carried out in order to check whether the provisions of the Seeds Act were being complied with.

The number of seed samples taken for testing for physical and genetic purity, germination and weed seed content was 2 385.

Cautions were issued in 585 cases where the provisions of the Seeds Act were being contravened; 328 cautions concerned seed that did not comply with the germination requirements.

Sealing lucerne seed

The quantities of lucerne seed which were approved and sealed after germination, physical purity and weed seed content had been checked, are shown in Table 2.

TABLE 2

Place where approved	Mass of seed approved and sealed (kg)	
	1979/80	1978/79
Oudtshoorn and Ladismith	1 020 000	1 154 850
Upington	75 000	47 000
Johannesburg	32 100	23 150
Total	1 127 100	1 225 000

The quantity of lucerne seed approved and sealed was 8% lower than the previous year. 108 000 kg of lucerne seed was exported.

Legislation

The proposed regulations, which are to be made under the Plant Improvement Act, 1976, were published in the Government Gazette on 28 April 1979 for comments and information.

SEED CERTIFICATION

This function includes the administration and application of the following schemes, which have as

their object the production of seed of a high quality:

- (a) *The Basic Seed Scheme*, in terms of which basic seed for the production of certified seed is grown under the Seed Certification Scheme and the OECD Scheme.
- (b) *The Seed Certification Scheme*, in terms of which variety-pure and variety-true seed of known origin is grown.
- (c) *The Export Seed Scheme*, in terms of which basic seed applied by overseas seed firms is multiplied in the Republic under official supervision.
- (d) *The OECD Herbage and Oilseeds and Vegetable Seed Schemes*, which are similar to the Seed Certification Scheme, but enjoy international recognition.

Quantities of seed certified

The masses (kg) of seed certified in terms of the various schemes are indicated in Table 3.

The quantity of seed certified was 13 408 578 kg lower than the previous year. The increase or decrease per crop group was as follows:

Vegetable crops	-	50,4 % decrease
Field crops	-	55,6 % decrease
Pasture crops	-	39,0 % increase

A total of 73 700 kg of dry bean seed was certified free of disease.

Table 4 indicates the number of inspections carried out and the total area inspected per crop group.

In all 31 merchants and co-operatives and 780 nurserymen participated in the schemes.

Seed of 32 kinds and 227 varieties was certified - an increase of 45 varieties in comparison with 1978/79.

International activities

Seed certification schemes of the Organisation for Economic Co-operation and Development (OECD)

South Africa continued its participation in the OECD Herbage and Oilseeds and Vegetable Seed Schemes. 630 tons of lupin seed was certified under

TABLE 3

Crop group	Basic Seed Scheme	Seed Certification Scheme	Export Seed Scheme	OECD Herbage and Oilseeds and Vegetable Seed Schemes	Total
Vegetables	2 696	513 974	75 167	-	591 837
Field crops	878 073	9 045 732*	-	356 700	10 280 505
Pastures	735	169 670	-	-	170 405
Total: 1979/80	881 504	9 729 376	75 167	356 700	11 042 747
Total: 1978/79	665 160	23 578 599	179 106	28 400	24 451 265
Total: 1977/78	1 113 191	26 637 499	156 862	2 532 187	30 439 739

* 6 248 300 kg of which was maize seed.

the OECD Herbage and Oilseeds Scheme. A large proportion of this seed was exported to the European Economic Community.

European Economic Community (EEC)

The Agricultural Counsellor (Economic) in Brussels keeps the Division informed of the introduction or amendment of guidelines on plant and seed matters. Close liaison is essential in order to comply with all EEC requirements for the export of plants and seeds to member countries of the community.

Table 4

Crop group	Number of inspections	Total area inspected and approved (ha)
Vegetables	1 271	2 835
Field crops (excluding maize)	909	13 060
Hybrid maize: white and yellow	3 156	7 529
Pasture crops	39	362
Total: 1979/80	5 375	23 786
Total: 1978/79	3 763	16 558

SEED POTATO CERTIFICATION

Foundation seed potatoes

Field screening

Stock seed potatoes from the Department's unit at Sabie are multiplied by the Potato Board at its foundation seed potato unit at Lydenburg. (Data for the previous year are given in brackets in all cases.)

The following varieties were planted in the following areas:

Variety	Area (ha)
BP 1	16,84 (12,12)
Up-to-Date	11,55 (12,20)
Van der Plank	2,00 (4,30)
Late Harvest	0,50 (0,20)
Buffelspoort	0,50 (None)
Total	31,39 (28,82)

Tuber inspection

The following quantities of seed potatoes were certified:

Variety	Number of units (30 kg) certified
Up-to-date	6 007 (6 959)
BP 1	8 478 (5 564)
Van der Plank	1 105 (2 082)
Late Harvest	477 (126)
Buffelspoort	181 (None)
Total	16 248 (14 731)

"AA" certification

Field screening

The AA standard is grown chiefly in the Northern Cape, the South-Western Free State and

to a lesser extent in the Transvaal, Natal and the Western Cape. 5 488 (5 610) ha was submitted for certification, a decrease of 122 ha. 843 ha (362) was rejected, chiefly owing to excessively high counts of certain viruses, particularly leaf roll and mosaic in Up-to-Date, Yn and BP 1 and bacterial wilt.

Tuber inspections

The quantity certified amounted to 685 494 x 30 kg (655 161 x 30 kg). 60 755 x 30 kg (75 283 x 30 kg) was rejected, chiefly for exceeding tolerances for nematode and potato tuber moth infestation and on account of *Rhizoctonia solani* infection.

"A" certification

Field screening

In the "A" area, which is situated chiefly in the Transvaal, the Eastern and the Central Free State and the Western Cape, 4 151 ha (4 394 ha) was submitted for inspection. Only 234 ha (145 ha) was rejected, chiefly as a result of virus and bacterial wilt infection.

Tuber inspections

The quantity certified was 634 876 x 30 kg (702 983 x 30 kg). A total of 49 271 x 30 kg (83 957 x 30 kg) was rejected, chiefly for exceeding the tolerances for nematode and potato tuber moth infestation and *Rhizoctonia solani* infection.

General

Varieties

The relative importance of the chief varieties of which seed potatoes were certified is indicated in Table 5.

TABLE 5

Variety	Quantity (30 kg units) of seed potatoes (classes "AA" and "A") certified	
	1979/80	1978/79
BP 1	535 549	540 525
Up-to-Date	517 759	549 856
Van der Plank	174 589	150 060
King George	21 908	17 875
Kimberley Choice	20 188	42 202
Pimpernel	12 775	12 305
Earliest of All	8 123	3 977
Sackfiller	6 484	9 852
Pentland Dell	5 876	8 935
Late Harvest	4 714	3 300
Koos Smit	4 060	997
Ilam Hardy	3 828	1 080
Total	1 315 853	1 340 964

Performance tests

In all 2 020 (2 094) samples were planted for purposes of performance testing. The tests provide an indication of the efficiency of virus disease

control by seed potato producers, whose continued membership of the Scheme depends on the outcome of these tests.

General

In contrast with the position during the previous year, only isolated cases of wilt *Pseudomonas solanacearum* occurred during the year under review and the areas involved were small. The precautions taken last year to prevent the spread of the disease were very effective.

VINES

Selected plant scheme

(a) Parent blocks

(i) Rootstocks

The number of rootstocks that complied with the requirements of the scheme in all respects decreased from 285 574 in 1979 to 90 290 in 1980. The number of blocks decreased to 52; these blocks are established at the nurseries of 21 registered nurserymen. This reduction is the result of rejection for virus diseases, withdrawal from the scheme and failure by nurserymen's associations to register under the scheme.

The following number of rootstocks qualified for certification (with figures for the previous year in brackets):

- Scions* : 332 000 (2 967 500)
- Cuttings for planting* : 40 000 (1 279 500)
- Rooted rootstocks* : 53 000 (291 500)

(ii) Scions

In co-operation with the nurserymen's association, 260 542 scions of all the most important varieties were inspected and approved on 31 properties. 81 793 grafted scions will qualify for certification during the winter of 1980.

S.A. Super Plant Scheme

(a) Parent blocks

(i) Rootstocks

To date 191 315 rootstocks have been established on the premises of 22 registered nurserymen, as against the 148 043 established on the premises of 14 nurserymen up to the end of the previous year.

The following number of rootstocks qualified for certification (figures for the previous year given in brackets):

- Scions* : 1 985 800 (1 424 680)
- Cuttings for planting* : 2 189 000 (1 160 360)
- Rooted rootstocks* : 419 500 (270 000)

(ii) Scions

Foundation plants of several varieties were issued to the multiplication organisation for multiplication in a foundation nursery. A total of

30 898 grafted plants are expected to be available for establishment during the winter of 1980.

(b) Nursery blocks

A total of 165 000 rooted rootstocks established in 7 nursery blocks during 1979 will qualify for certification during the winter of 1980.

A further 1 010 000 cuttings for planting will be established in 7 nursery blocks during 1980.

POMES AND DRUPES

Selected Plant Scheme

Draft regulations for this scheme have already been drawn up and have replaced the existing scheme for the best available material. A total of 17 nurserymen are already participating in the scheme.

(a) Rootstocks

Nurserymen are self-sufficient, but use rootstock material from the Super Plant Scheme when it is available.

(b) Scions

In all 443 080 scion buds were supplied by the SAPIO to nurserymen who qualified.

(c) Nursery blocks

A total of 41 978 nursery plants of several kinds will qualify for certification as SA selected plants during the winter of 1980.

Super Plant Scheme

This scheme is starting to grow in accordance with expectations and certified super plants should be fairly freely available within a foreseeable period.

(a) Parent blocks

(i) Rootstocks

The following number of registered plants have so far been established in 34 parent blocks, from material supplied by the SAPIO:

Rootstock	Established 1979	Established previously
M 793	19 660	13 588
Marianna	3 451	3 073
MM 106	1 740	2 127
Quince A	345	983
BP 1	-	34
Total	25 196	19 805

The propagating material received from this source will be used as rootstocks in nursery blocks.

(b) Nursery blocks (figures for the previous year given in brackets)

(i) Rootstocks

A total of 19 nurserymen laid out nursery blocks during 1979, as against 14 the previous year. The following kinds and numbers of each kind were established in nursery blocks:

Pear rootstocks	142 250 (335 714)
Apple rootstocks	164 910 (189 348)
Peaches, apricots and plums	20 900 (75 000)
Total	328 060 (600 122)

This dwindling in the supply of rootstocks may be ascribed to the market for year-old trees.

(ii) Scions

The kinds and numbers of certified buds and grafts which were issued by the SAPIO to nurserymen who qualified and possessed the necessary rootstocks, are indicated in Table 6.

TABLE 6

Kind	Number of buds	Number of grafts
Pears	178 722 (124 450)	4 600
Plums	330 145 (70 450)	-
Apricots	198 500 (44 100)	250
Prunes	17 585 (17 700)	-
Apples	252 074 (17 150)	2 150
Total	977 026 (273 350)	7 000

(iii) Super plant trees

The following kinds and numbers of trees were certified as SA super plants during the winter of 1979:

Plums	10 550 (45 819)
Pears	12 100 (23 995)
Prunes	3 125 (15 140)
Apples	10 825 (11 070)
Apricots	931 (2 099)
Total	37 531 (98 123)

The certification of the first super plant trees was a notable advance towards the provision of disease-free true-to-type deciduous fruit propagating material.

Strawberry scheme

The scheme is still making a positive contribution to the boosting of yields and the improvement of quality. Ten nurserymen are participating in the scheme and 104 250 plants were certified during the past season.

Cherry scheme

4 500 cherry trees were certified during the past season. 500 Mahaleb B40 cuttings were issued to nurserymen by the Cherry Experimental Farm at Ficksburg.

INSPECTION OF FLOWERING BULBS FOR EXPORT

There was a slight increase in the area planted as against the previous year. In all 12 winter bulb varieties, covering an area of a 69,76 ha, were submitted for inspection and 21,12 ha, planted to 19 summer bulb varieties, was submitted for inspection and approved.

NURSERIES

Registration

The registered nurseries are distributed as follows over four provinces:

Transvaal	1 238
Cape	916
Natal	406
OFS	96
Total	2 656

427 nurseries are situated in the Witwatersrand area and 315 in the Pretoria area.

Inspections

3 403 visits were paid to nurseries for purposes of inspection and 952 plant samples and 7 soil samples were submitted for examination for insects and plant diseases declared under the Agricultural Pests Act.

Quarantine was imposed at 100 nurseries on account of the occurrence of harmful insects and plant diseases. The total number of plants affected by the quarantine was 618 578. Infestation with rootknot nematode (398 621 plants), *Phytophthora* (127 048 plants) and crown gall (75 036 plants) were the most important reasons for the imposition of quarantine. 418 838 infected plants were voluntarily destroyed by nurseries.

Stocks of plants at nurseries

In order to supply more reliable information on the stocks of plants at nurseries, a survey of all the nurseries that grow plants was started during the year under review. The information will be made available in the 1980/81 annual report.

PEST CONTROL

A total of 446 wart disease permits were issued during the past year and 48 permits were issued for the transportation of banana plants after soil samples had been found to be free of burrowing nematode.

QUALITY CONTROL IN RESPECT OF IMPORTED AND EXPORTED SEED

Imports

(a) Seed declared under the Seeds Act

Table 7 indicates the quantities (kg) of seed of

TABLE 7

Crop group	Normal sales	Experimental purposes	Canning/processing	Because of shortages of seed of suitable varieties	Production of fresh products for export	Multiplication of seed for export	Immediate re-exportation
Forage grasses	1 182 189	-	-	-	-	-	204
Forage legumes	287 769	300	-	2 000	-	-	-
Field crops	3 840 201	4 482	-	-	-	2 820	2 025
Vegetable crops	178 927	1 109	955 929	-	1 099	16 087	-
Total 1978/79	5 489 086	5 891	955 929	2 000	1 099	18 907	2 229
Total 1977/78	4 533 788	2 016	2 146 675	6 450	2 050	9 560	763

the various crop groups and the purposes for which the seed was imported.

The total quantity of seed imported was 6 457 123 kg - 230 499 kg less than during the previous year. On the basis of the mass of seed imported, the various crops represented the percentages shown in Table 8. Figures are given for the last 5 years.

Table 8

Crop group	1979-80	1978-79	1977-78	1976-77	1975-76
Forage grasses	18,26	7,676	17,93	7,02	10,25
Forage legumes	4,47	6,351	5,00	1,94	14,09
Field crops	59,47	43,300	59,93	49,22	47,80
Vegetable crops	17,80	42,672	17,14	41,82	27,86

The largest quantity of seed, namely 76,73 % of the total, was imported through the ports of Cape Town and Durban and through City Deep.

Of the total quantity of seed imported during the year, 2,57 % did not meet the prescribed requirements.

Table 9 shows the mass or quantity of the various types of imported plants, plant products, apiary products and insects checked for phytosanitary purposes.

TABLE 9

Nature of imported material	Mass or quantities inspected (kg, unless otherwise indicated)
Plants and cuttings	2 014 521 units
Flowering bulbs, tubers and rhizomes	16 612 906 units
Seed potatoes	311 415
Seed (for propagating)	6 116 828
Seed (commodities)	151 887 320
Tobacco	7 589 006
Deciduous fruit	15 578
Citrus and subtropical fruit	934 231
Cotton lint	31 181 787
Broom-reeds, plant fibre etc.	5 987 238
Beeswax and apiary products	34 501
Nuts	6 299 898
Timber	212 829
Herbs, spices, ginger etc.	1 937 605
Cut flowers (fresh or dried)	3 426
Malt	1 335 251
Herbarium specimens	520
Live insects	9
A total of 11 859 imports were inspected	

473 consignments were held back on account of illegal imports, inadequate documentation,

infestation by insects or infection with plant diseases, and prohibited imports.

Exports

Table 10 shows the quantities of the various kinds of plants, plant products and apiary products certified for phytosanitary purposes prior to being exported.

TABLE 10

Nature of exported material	Mass or quantities certified (kg, unless otherwise indicated)
Plants and cuttings	54 809 476 units
Flowering bulbs, tubers and rhizomes	64 172 084 units
Seed potatoes (SA-certified)	42 705 410
Table potatoes	8 314 984
Fresh/frozen vegetables	13 246 651
Fresh fruit	
(i) Deciduous fruit	122 213 746
(ii) Citrus and subtropical fruit	263 500 323
(iii) Other	243 527
Groundnuts	15 900 419
Maize and orghum	1 867 020 930
Cut flowers (fresh or dried)	2 890 004
Timber	987 318
Nuts	26 640
Wheat, tobacco, fowl feed, etc.	68 911 670
Seed	
(i) SA-certified	69 174
(ii) Uncertified	17 002 541

On 21 September 1956 South Africa joined the International Convention for the Protection of new Plant Varieties. The object of the Convention is to prevent, as far as possible, the spread of injurious plant pests from one member country to another. The Convention was modified in 1979, the first time since it came into operation in 1952.

Under the Convention approximately 15 000 phytosanitary certificates relating to the phytosanitary condition of export plants and plant products (including seed) and about 4 300 plant import permits setting out the phytosanitary requirements for imported plant material have been issued.

QUALITY CONTROL

GERM PLASM AND PLANT INTRODUCTIONS

Germ plasm bank

Two hundred and ninety-five specimens were added during the period under review. This brings the total to over 7860. The 8th volume of the Index Seminum was published and distributed. A number of deep freeze units for the long-term storage of seed were commissioned.

Plant introduction

During the period under review 8030 plant specimens were supplied in response to enquiries from overseas and 1578 in response to local requests. 8432 plant specimens were received from outside bodies.

Tests for variety trueness

The Division exercises strict control over the purity, germination, phytosanitary condition and variety trueness of the kinds declared under the Seeds Act. A varietal list maintained in terms of the Seeds Act contains the names of varieties that are on the market or are imported. To qualify for inclusion in the varietal list, a variety should be distinguishable from other varieties, homogeneous and stable and should have an acceptable name.

Once a variety has been included in the varietal list continuous control is exercised by taking seed from the trade and the experimental plots, planting it and evaluating it for variety trueness and purity.

Inclusion of new varieties in the varietal list

Applications for inclusion in the varietal list were received for 102 new varieties, the majority being maize, sunflowers and grain sorghum varieties. This is the first time in the history of the Division that the 100 mark has been exceeded during a single year.

Fifty-five new varieties, of which maize accounted for the highest percentage, were included in the varietal list.

Testing for variety trueness and purity

Tests were carried out on 4471 samples of 61 kinds of imported, certified seed and seed from the trade. This is a slight increase on the figure for the previous year.

Over 100 samples of 12 kinds - mainly potatoes, maize and grain sorghum - were tested.

Plant breeders' right

With the declaration of Lachenalia, the number of kinds of plants declared under the Plant Breeders' Rights Act (Act 15 of 1976) now stands

at 82.

The annual number of applications for plant breeders' rights reached a virtually constant level after the initial influx of applications immediately before Act 15 of 1976 came into operation.

The most important of the plants for which plant breeders' rights are requested are soya-beans, dwarf beans, tomatoes, peaches, apples and roses

From the applications received it appears that there is considerable interest in the development of ornamental varieties from indigenous species. The following numbers of licences were issued up to 31 March by holders or their agents:

Roses - 51, peaches - 3 and nectarines - 2.

South Africa has been a member of UPOV since 6 November 1977.

Israel became the 11th member of UPOV on 12 December 1979.

A Plant Breeders' Rights Amendment Act in which provision is made for the amendments to the Convention for the Protection of New Plant Varieties approved during the diplomatic conference held in October 1978, and which will enable the RSA to ratify the revised Convention, was adopted during the 1980 Parliamentary Session. South Africa still maintains reciprocal agreements on plant breeders' rights with the USA and Zimbabwe.

Breeders' plant material

The purification and maintenance of varieties developed by the Department and certain "open" varieties in order to obtain propagating material of high genetic quality for use in the production of certified material was continued in co-operation with officers from several Regions and Institutes.

Table 11 indicates the kinds, varieties and quantities of breeders' seed produced and issued.

TABLE 11

Kind	Number of varieties	Quantity produced (kg)	Quantity issued under the Seed Certification Scheme
<i>Vegetable crops</i>			
Beans	1	97	243,5
Pumpkins	1	63	
Tomatoes	1	12,6	,75 g
Onions	4	21,5	7,6 kg
Peas	4	343	
Gem squashes	1		2 kg
<i>Field crops</i>			
Lupins	1	18 200	
<i>Pasture crops</i>			
Rye grass	1	1 300	

THE ANALYSIS, TESTING AND EXAMINATION OF SEED

The Division's Seed Testing Station tests and examines seed samples for purity, germination, moisture and weed seed content and other quality related properties.

TABLE 12

Seed group	Seed certification	Public	In terms of Seeds Act Seed trade		Research Imported	Total
Field crops	1 602	3 081	1 807	284	241	7 015
Horticulture	561	3 300	1 039	590	36	5 526
Forestry	-	46	-	-	183	229
Total	2 163	6 427	2 816	874	460	12 740

Table 12 shows the range of the activities undertaken at the Station.

Maize, sunflowers, onions and beans were the most important crops of which specimens were received for analysis and investigation.

The total number of tests carried out was 23 102. This is lower than the figure for the previous year, despite the fact that there was an increase of about 60 % in determinations of weed seed content.

During the past 21 years samples for seed analysis increased from about 6 000 to about 18 000 per year.

South Africa continued its membership of the International Seed Testing Association (ISTA). The following officers serve on committees of the Association:

Mr J.F. van Wyk

- (a) Executive Committee
- (b) Rules Committee
- (c) Seed Moisture and Storage Committee (Chairman)
- (d) Flower Seed Committee

Miss E. Robert

Seed Purity Committee

These committees were actively engaged in revising the international seed testing rules.

The number of international seed analysis certificates issued was 147.

III. Animal Production Improvement

LIVESTOCK PRODUCTION RESEARCH

BEEF CATTLE

Production systems: At **Kokstad** great value is attached to maintaining a proper balance between the condition of the cattle and the condition of the veld. Research is therefore carried out on selection preferences and their effect on the condition and composition of the veld. In one instance two herds were included in a grazing programme; one was given preference by being allowed to graze rested veld whereas the other had to graze whatever remained. The masses of the group that received preference were about 25 kg per animal higher than those of the second group, partly because they were able to select a diet containing 8,1 % crude protein as against 7,0 % crude protein for the second group.

The advantages of a salt/phosphate lick during summer and an energy/protein lick during the following winter were clearly underlined at **Athole**. It was possible to market culled oxen and heifers at 32 months from the veld after an average daily increase of 760 g. The dressing percentage was 50,5 % and the carcase mass 275 kg, which is very good for sourveld. Good progress with weaning masses continues to be shown every year on the semi-intensive unit at Athole. This year there was a 7,7 % improvement.

At **Nooitgedacht** few differences in respect of conception percentages and weaning masses of calves were found between cows on winter treatments that varied from submaintenance to nutritionally sound. The cows and their calves were apparently well able to compensate for their losses of mass. The conception figures varied from 87 % to 94 % and the weaning masses from 187 kg to 201 kg.

Favourable economic results with strategic maize-meal supplementation on summer veld and winter licks were obtained at **Potchefstroom**. A mass increase of 0,57 kg/ox/day during winter was better than maintenance wintering, and maize-meal supplementation during the last half of the summer better than supplementation during the entire summer. Since carcase masses and quality did not differ greatly, the former treatment was better from the point of view of economics.

The effect of the feeding level during wintering, following weaning, on the lifetime production of Shorthorn and Bonsmara heifers is being studied in the **Eastern Cape**. Although there are initial advantages in higher feeding levels than

maintenance, there is no lifetime advantage. It is true, however, that heifers that calved for the first time at 24 months at these feeding levels showed a permanent disability and only attained 69 % of the adult mass at six years. This had a harmful effect on the reproductive capacities and on the birth and weaning masses of their calves.

The enormous phosphate shortage in the **Vryburg** area was again underlined in the course of a study at **Armoedsvlakte**. Cows that received phosphorus supplementation weighed an average of 100 kg more during autumn than those that received no phosphorus and their conception percentage was 79,2 % as against 45,8 %. On the other hand phosphorus supplementation in the **Glen** area showed only slight advantages, in the shape of a 10 % higher weaning mass.

Grazing and pasture improvement: The performances of dual-breed and British breed cows and their calves on kikuyu pastures are being compared at **Cedara**. Stocking rates of 4,6 and 7 cows and calves per ha are used. Weaning masses were 218 kg and 190 kg for the dual-purpose calves at the low and high stocking intensities, respectively, and 208 kg and 170 kg for the British breed calves. Cows at the low stocking intensity were able to graze 30 days longer during the summer growing season, but this did not have any real effect on the reproduction performance of the groups.

At **Potchefstroom**, where the natural veld is fertilised, the stocking rate during the past year was 126 % higher than the rate on unfertilised veld. Notwithstanding this high stocking rate, the average daily increase of the calves was 10 % higher on fertilised veld, and the mass increases per ha of both calves and lambs 150 % higher.

Feeding programmes for finishing oxen: Monensin sodium in finishing diets appeared to have a differential effect in a study at **Potchefstroom**. Feed conversion to carcase mass was 12 % better when a 60:40 concentrate:roughage diet was fed, but the addition of monensin sodium had no significant effect when a 80:20 ratio was applied. The latter diet, without monensin sodium, also proved to be the most economic of the diets fed in the study.

Big programmes are being launched at both **Potchefstroom** and **Irene** in order to compare various sources of roughage in finishing diets. Maize silage and *Eragrostis curvula* as sources of roughage produced comparable results when 80 % concentrates were used in the diets, but not when 60 % concentrates were used. The inclusion of *Eragrostis* hay produced a marked reduction in the dressing percentage. The ideal levels of inclusion of roughage in finishing diets were also determined at

Irene. For pelleted bagasse the ideal level lies between 24 % and 30 %, for unpelleted bagasse it lies between 12 % and 18 %, for *Eragrostis* it is around 20 %, as for wheat straw, and for sunflower hulls it is around 10 %. The size of the particle in the form of which the roughage is presented appears to have a significant effect on the desirable level of inclusion. For instance, the desirable level of inclusion of 12 %-18 % in the case of a 50 mm hammer-mill screen changed to 18 %-24 % when a 25 mm and a 12,5 mm screen was used and to 30 % when a 6,25 mm screen was used.

The possibility of using whole kernel maize instead of ground maize for finishing was also investigated at Irene. This was necessitated by the high cost of grinding maize and the cost of storing roughage; with whole kernel maize less roughage can be used than with ground maize. Whole kernel maize was not as successful as maize-meal as a supplement to *Eragrostis* hay, and neither was crushed maize. Whole kernel maize appears promising for high energy finishing diets, but there are decided biological and economic advantages to treating it by chemical means, e.g. with low concentrations of caustic soda or propionic acid. The chemical treatment of whole kernel maize also appears to provide a promising alternative to maize meal.

Breed evaluation in cross-breeding programmes: Several cross-breeding projects with Africander, Charolais, Hereford, Simmentaler, Brahman, Blonde d'Aquitaine, Chianina, Limousin, Gelbvieh, Normandie, Maine Anjou and Bonsmara as bull breeds and Africander and Jersey as cow breeds were launched at the Vaalharts Research Station. It was clearly evident that Brahman and Simmentaler crosses with the Africander as the mother breed produced excellent female breeding animals. Charolais crosses did not produce such good dam material, chiefly because of a high incidence of calving problems. All the crosses did better than the pure-bred Africanders in regard to weaning mass and post-weaning growth. Especially good conception figures were obtained with Bonsmara, Brahman and Hereford as pure breeds and Brahman, Charolais, Hereford and Simmentaler ex Africander cow crosses. With Jersey crosses the reproduction capacity and lifelong weaning mass production per 100 kg of cow mass were very good. It is therefore clear that cross-bred Jersey cows make inherently good dam material for the production of weaners.

At Mara the long-term criss-crossing and three-way crossing programmes appear to be successful in respect of the maintenance of hybrid vigour. Weaning masses for Africander, Hereford and the fifth generation of criss-crosses between the two were 189 kg, 184 kg and 208 kg, for instance, whereas weaning masses for Africander, Simmentaler and the criss-crosses were 189, 246 and 226 kg, respectively. The latter figure is more than the average for the two parent breeds. In the three-way cross with these breeds the figure of 223 kg was also considerably higher than the

average of 206 kg for the three parent breeds. Similar tendencies were noticeable in respect of the weaning mass production per ha and post-weaning growth of heifers on the veld.

MUTTON SHEEP AND GOATS

Development of a white-woolled mutton breed

Experiments aimed at the development of a white-woolled mutton breed were started at the Carnavon Experimental Farm in 1969. It appeared that, of the various crosses made with the Merino ewe as the dam, the crossing with the composition of 50 % S.A. Mutton Merino, 25 % Merino and 25 % Ronderib Africander produced the best results. It was also decided that this crossing could form the basis for the development of a white-woolled mutton breed under extensive grazing conditions. A breeder's society was founded with a view to the further development of the breed, which will take the form of a co-operative project. Breed standards have been drawn up with regard to conformation and wool cover. Production performance measurements will be carried out and this will serve to introduce collaborators to performance testing.

Dorper sheep

It is widely known that farm animals maintain different growth rates under comparable conditions. These differences may be ascribed to several factors, such as voluntary feed intake, differences in body composition and differences between breeds and sexes. The differences in body composition between animals imply differences in composition of body mass increase at any particular time. These differences affect not only the efficiency of feed energy consumption, but also production efficiency in terms of feed conversion. As a result of this it has become necessary, since there are about 5,2 million Dorpers in the Republic, to quantify production efficiency and body composition: It is clear that gross efficiency decreases with an increase in body mass and age. On the whole rams were found to be more efficient than ewes and wethers. These differences are reduced during the later stage of growth; indeed at the same age (39 weeks, end of trial) rams and ewes showed the same gross efficiency. It was notable, however, that in the case of wethers the decrease in efficiency levelled out after a body mass of about 50 kg. Rams required less metabolisable energy (ME) for a specific mass increase than ewes or wethers and wethers required less than ewes.

A very important factor that contributes to differences in growth rate is the ratio in which protein and fat are deposited during growth. Where total proteins and fats were compared at a specific body mass, rams had more protein and less fat than ewes and wethers. In addition, after a body

mass of 50 kg ewes had more protein, and from 25 kg onwards more fat, in their bodies than wethers did. As expected, rams had the most protein at the end of the trial, wethers the most fat and rams the least fat.

Reproduction of ewes

At **Cedara** the part played by pregnant mare serum (PMS) as a luteal supporter after treatment with gonadotropin releasing hormone was investigated. Lactating ewes were injected with GnRH 25 days after lambing and PMS was administered intravenously for 15 days subsequently. The PMS treatment resulted in an increase in luteal activity. The results indicate that, with the necessary hormone treatment, ewes could possibly become pregnant within 30 days of lambing.

White muscle disease

White muscle disease in lambs is generally caused by a selenium-vitamin E deficiency in their dams. This disease caused lamb losses at **Cedara**. During an investigation in which selenium and Vitamin E supplements were given, it was not possible to establish the cause of the disease. The condition may be aggravated by the high demands made on the ewes by eight monthly lambing seasons.

Phosphate feeding

It was indicated in previous annual reports that phosphorus supplements for Merino ewes on veld grazing have few if any advantages. There were the same doubts about the advantages of this practice for Dorper ewes at **Koopmansfontein**. A group of Dorper ewes was transferred to Armoedsvlakte so that the possibility of a phosphorus deficiency could be investigated in an area where the pastures were undoubtedly deficient in phosphorus. Although the blood phosphorus content of the Dorper ewes fell to far below the generally accepted safe level during lactation, this had no effect on the growth of their lambs.

PIGS

Feeding

When alcohol is manufactured from maize the maize is fermented by yeast cells in order to convert the starch to alcohol, carbon dioxide and other carbohydrates. The remaining nutrients, such as proteins, fat and minerals, become 300% concentrated. The residues are dried and are known as maize fermentation residues. During a study to evaluate the residues as a source of food for pigs, five levels of maize fermentation residues, ranging from 15% to 35%, were included in pig grower rations. The inclusion of up to 35% produced satisfactory growth and feed conversion values.

The price at which maize fermentation residues can be economically included in pig rations

was calculated with the aid of a computer. To ensure a level of inclusion of not less than 35%, the maximum price should not be more than 8,3% higher than the price of maize.

If maize is used for the production of alcohol in future, about 600 000 tons of maize fermentation residues are expected to be produced annually. About 500 000 tons of pig feed are produced annually and this means that 175 000 tons of maize fermentation residues could be used annually for pig feeding.

In view of the increasing rise in feed costs, research in the **Winter Rainfall Region** centred mainly around feeding during the past year.

Two locally available sources of feed, namely fish silage and wine yeast, were evaluated as protein sources in pig grower rations. Unlike wine yeast, which has a very low digestibility for one reason or another, and therefore has only a limited nutritional value, fish silage appears to have exceptional possibilities for pig finisher rations. Fish silage completely replaced fish meal in finishing rations without any harmful effect on the growth rate, feed conversion efficiency, carcass quality and meaty flavour of baconers.

The quality of fish meal and sunflower oilcakes, which are produced in the Republic, was investigated. Differences in the biological usefulness of amino acids in both the products were observed and may be traced back to processing conditions, such as high processing temperatures, to which the products were subjected. It was proved that the two products had been subjected to processing temperatures that reduced their usefulness.

Reproduction

The storage of boar semen at 15 °C was investigated. Incubation studies showed that the Kiev diluent produced better motility after incubation at 15 °C and 37 °C than a Tris diluent. Thirty-four young sows and 47 adult sows were inseminated; the fertility figures were 82% and 86% respectively and the average litter sizes 9-10 piglets. The use of fluid semen in the practical application of AI can therefore now undergo further investigation in a pilot scheme before final application in practice is recommended.

The effect of seasons on the reproduction potential of sows was investigated. The season was found to have no effect on the number of piglets born, dead or alive. During summer the number of days from weaning to the return of oestrus again increased by an average of four days. The number of days from weaning to conception also increased during summer - by over six days - which is an indication of a reduced conception figure during summer. It would therefore appear that reproduction in the pig is adversely affected during summer. The total number of slaughterings provides corroboration for this view. During November and December there is an annual decrease in the number of baconers marketed,

which is further evidence of the reproduction problem 10 months earlier.

POULTRY

The enormous increase in feed costs makes it necessary to take a more critical look at the minimum nutritional requirements of poultry. The provision of the most critical amino acid, lysine, plays an important part in determining feed prices. Consequently a great deal of attention is being given to the use of different levels of lysine and their effect on laying hens from various breeders.

Research on the effect of seasons (temperature) on feed intake is also being carried out with a view to the possibility of formulating cheaper rations during certain seasons. Attention has also been given to a shorter method of determining the energy content of feed constituents and rations more accurately.

MEAT SCIENCE

Electrical stimulation

Research carried out at the Animal and Dairy Science Research Institute in connection with the electrical stimulation of recently slaughtered beef carcasses in order to prevent toughening of the meat during rapid chilling showed that there is approximately a 100 % difference in tenderness in the most expensive meat from carcasses that had been stimulated as against carcasses that had not been stimulated. As a result of these significant findings the industry has just installed the first stimulator at a meat factory. This piece of equipment was manufactured entirely in South Africa. At present the Republic is one of the leading countries with regard to the application of this technique in the meat industry.

Shelf life of meat

A systematic programme, in which factors that help determine the length of the shelf life of fresh meat are being studied, is being carried out by meat microbiologists. The starting point is the study of the carcass. At a large public abattoir it was found that the high bacterial load present immediately after the removal of the hide of a beef carcass is slightly reduced during the subsequent slaughtering process, but shows an evident increase instead of the expected decline after the carcass has been sprayed with cold water. The carcasses are then pushed into cold rooms, where they are both dried and cooled. These dry, cold conditions were responsible for reducing bacterial counts on carcass surfaces considerably, so that they reached a hygienically acceptable level. The dry surface and temperature of about 0 °C in the cold room therefore do inhibit the growth of several types of micro-organisms capable of having an adverse effect on the keeping quality of meat.

Beef carcass value

In order to determine the relative value of the cuts of a beef carcass, a 12-month survey was carried out at 60 abattoirs and supermarkets in the Pretoria and Witwatersrand areas. The information obtained was processed and summarised in the following table. The prices of all Super, Prime and First Grade carcasses were included in these calculations. Owing to the variation in the values of cuts it was found, for instance, that the heaviest cut in the carcass, the brisket, with a mass of 12,47 %, represented 10,6 % of the value of the carcass, and that the topside, which has a mass of only 8,08 % of the carcass, represented 11,0 % of the value of the carcass. This was due to difference in the unit prices, which were 173 and 279 cents per kilogram for brisket and topside, respectively. A comprehensive description of techniques of cutting up a carcass, and the composition and value of beef carcasses, is given in the brochure "The Cuts of a Beef Carcass", compiled by the Animal and Dairy Science Research Institute.

Freezing of meat cuts

It is often customary at meat factories to debone beef carcasses, pack the meat and store it frozen until it is required for further processing. During thawing considerable losses of meat juices take place, depending on the efficiency of freezing and the properties of the meat in the cut. It was found in trials that the more expensive meat in the carcass, namely the fillet, loin, rump, thick flank and topside, loses about 5,8 % moisture during thawing as against only 1,4 % in the cheaper cuts such as the neck, shoulder, thick rib, brisket, shanks and flank, if both groups of cuts are frozen at -28 °C. It was found, however, that if the temperature is only -15 °C, the corresponding figures are considerably higher, namely 7,22 and 2,31 % respectively. It is therefore important for the industry to note that the expensive meat in a carcass is more subject to thawing losses than the cheaper meat and that rapid freezing can play an important part in reducing such losses.

"Blood splash" in beef

When cattle are not bled rapidly enough after stunning, small haemorrhages may occur in the muscles and these result in the occurrence of intra-muscular blood clots or blood spots. Such meat is aesthetically less acceptable to the consumer and its keeping quality may also be impaired. It was found in the course of surveys at abattoirs from which such meat is received from time to time that the interval between stunning and severing the blood vessels was 66,3 seconds on average, and varied from 10 to 210 seconds. At a second abattoir used for comparative purposes the average interval was 49,5 seconds, with a variation of 10 to 130 seconds. This shows that the improvement of this step of the slaughtering process is practicable and would lead to an improvement in meat quality.

Carcase cut	Mass of cut as % of carcase	Price of cut, c/kg	Value of cut as % of carcase	Price index of cut *Prime rib = 100
Hind shin and foreshin	6,41	147	4,6	75
Topside	8,08	279	11,0	142
Silverside	7,27	278	9,9	141
Thick flank	4,33	268	5,7	136
Rump steak	5,43	374	10,0	190
Fillet	1,61	414	3,3	210
Loin	5,11	294	7,4	149
Thin flank	7,32	184	6,6	93
Wing rib	2,87	206	2,9	105
Prime rib	3,27	197	3,2	100
Brisket	12,47	173	10,6	88
Chuck	9,62	179	8,4	91
Bolo	8,60	235	9,9	119
Neck	7,76	144	5,5	73
Fat	2,34	25	0,3	13
Kidney	0,34	158	0,3	80
Bone	7,18	21	0,7	11

*The prime rib is the cut which is the best indicator of the average value of the carcase.



At its annual Merino ram sale, Grootfontein sold the most expensive ram ever sold at a South African sale. The ram realised the record price of R18 000. Here he is with his new owners, Messrs T. Barry (far left), A.J. van As (second from left) and P. van N. Swart (far right). In the centre is Mr J.A.A. Baard, officer-in-charge of the Merino stud breeding project at Grootfontein, and Mr J.M. Cloete, collaborating officer of this project

Evaluation of indigenous beef breeds

During the past few years the Animal and Dairy Science Research Institute has in co-operation with the authorities of the national states concerned, been investigating the growth

capacity, carcase value and eatability of the meat of Nguni, Sanga and Pedi oxen and bulls. The growth rate of post-weaning age bulls under feedlot conditions was 1096 900 and 886 g per day, respectively, for the three breeds, with an efficiency of feed conversion of 8,3, 7,5 and 8,4, which clearly

illustrates the potential of these animals for fattening in comparison with a breed such as the Africander. Bulls slaughtered at a live mass of 350 kg produced a carcass mass of about 200 kg and the carcasses had a good enough fat cover to be placed in the present Super and Prime grades. Such carcasses were produced at ages of between 18 and 20 months.

The growth rate of the oxen in feedlots was between 30 % and 40 % lower than that of bulls and varied from 640 to 850 g per day. The performance of oxen as feedlot animals was therefore considerably poorer but oxen do have potential for the production of good quality carcasses from the veld.

A fairly big variation in growth performance is found within every breed, which clearly illustrates the potential for genetic selection and improvement.

Cross-breeding

Over the past few years several bulls of exotic breeds have been crossed with Africander cows in a combined project undertaken by the Free State Region and the Animal and Dairy Science Research Institute. In the most recent analysis of the data available so far, the following crossings born of Africander cows were evaluated as weaner calves in feedlots: Hereford, Simmentaler, Gelbvieh, Normandie, Limousin, Blonde d'Aquitaine, Charolais and Chianina. Average daily increase was highest in Simmentaler, Gelbvieh and Charolais, but feed conversion was best in the latter two types and Chianina. With regard to the dressing percentage, the highest values were found in the case of Limousin, Blonde d'Aquitaine and Charolais, and carcass compactness or meat thickness was also highest in these three types. The Chianina crosses had carcasses with the flattest conformation of all the types and nevertheless had the highest percentage of expensive meat in the carcasses. The three types that had the least fat in the carcasses and the least subcutaneous fat were Blonde d'Aquitaine, Charolais and Chianina, and these were also the three types with the highest percentage of expensive meat in the carcasses. A very close relationship was found between carcass fat content and the proportion of expensive meat in the carcass. The Hereford and Normandie crosses were the fattest and had the lowest percentage of expensive meat in the carcasses. The tenderest meat was found in Charolais and Chianina crosses.

The differences in physiological age, which are very closely related to dressing qualities of the various types, are very clearly illustrated by this research on type evaluation, which is providing very valuable information on the optimum marketing stages for different types of beef cattle. The work is proceeding.

WOOLLED SHEEP

The high potential of the Merino stud herd was again confirmed by high production figures:

Average clean wool production from unselected two-tooth ewes was 5,00 kg and that from unselected two-tooth rams 6,29 kg for the 1979/80 season. A record price (R18 000) was paid for a Merino ram in 1979. Thirty rams produced an average record price of R2 485.

The most important findings of the selection trial at the **Carnarvon** Research Station were the following:

- (i) The percentage of lambs weaned per available ewes was 70 %.
- (ii) The average mass of the ewes at 18 months was 30 kg and full reproduction potential was only attained at 3,5 years.
- (iii) Production and reproduction declined drastically at and after seven years.
- (iv) Very little progress with selection, measured as a deviation from the control, was observed in any wool property.
- (v) It appears that the natural nutritional status is too low to make selection for wool properties effective.

Quality studies at **Grootfontein** are concerned with the causes and elimination of quality deviations in wool. Weathering of wool remains a problem in the Karoo Region. By regulating shearing times correctly and providing shade the problem can largely be controlled.

The supplementation of energy, protein and phosphate to Merino sheep on four different veld types is being investigated at Grootfontein. Preliminary data show that no advantages are obtained in respect of body mass, lambing percentage, weaning mass and wool production.

In the course of a study of the chemical composition of oldman salt-bush, chemical analyses were made of samples taken in various ways. Samples taken three-weekly, over a period of a year, from oesophageally fistulated sheep, showed that the animals selected plant material containing 44 % nitrogen-free extract, 15,7 % crude protein, 16,3 % crude fibre and 21,5 % ash. The results showed that sheep selected a more balanced diet than had been expected.

In the **Free State Region** special attention is given to bridging the critical periods by supplying nutrients to wet ewes on natural pastures in the Central Orange Free State. Climatic conditions make it impossible to establish winter cereals for grazing every year. To meet the nutritional needs of lactating ewes and their lambs, licks are provided as supplementation. Results show that supplementary protein and phosphorus do not have a significant effect on the total production of Merino wethers on natural grazing. However, the nutritional requirements of lactating ewes are considerably higher than those of dry sheep. The response of wet ewes on their lambs on protein and energy supplementation is therefore being measured. In order to arrive at an optimum level of supplementation, various levels of supplementation are being investigated under grazing conditions. Supplements pass directly into the rumen of the

sheep. Measurements are carried out on the digestive process in the rumen.

Accelerated reproduction programmes under various combinations of grazing conditions constitute one of the pastoral science development programmes in the high potential areas of the Eastern Cape. Five completed breeding cycles of eight months have yielded the following increases in production: Lambing percentage from 115 to 140 %, meat production from 92 to 120 kg/ha and wool production from 20 to 22 kg/ha.

Young ewes 10 months old are mated at an initial mass of 45 kg; 80 % of the production income is derived from meat. High fecundity and liveability are a priority in such systems.

Effective wintering programmes are essential for sustained animal performance on the sourveld, especially where sheep and cattle have to be wintered on the same veld. The following findings were obtained on **Dohne** sourveld: Cattle run together with sheep (1:6) select a diet 31 % higher in crude protein than the average of the grazing and sheep select a diet 69 % richer in crude protein than the average of the diet. The result is that if the same composite lick is fed to both, sheep take in 0,21 g and cattle 0,42 g of nitrogen per metabolic size from the licks. On Dohne sourveld with a yield of 1 900 kg of DM/ha a stocking rate of four cattle and eight ewes (with lambs) makes no difference to animal performance. In all cases sheep were less sensitive to the intensity of the stocking rate.

In a crossing trial at the Nooitgedacht Research Station back crosses were carried out with F₁ sheep. Skin sections from the groups show that in the main the new crosses tend to show the properties of the parent rams in their follicle groups rather than those of the Merino. This means that follicle distribution is sparse, the sebum glands are large and the connective tissue bands broad. Isolated cases where the skin properties tend towards those of the Merino do occur. This is more evident in the ewes than in the rams. Furthermore, the components of the follicle group are not as well developed in the ewes as in the rams.

The fecundity of the crossings in the Nooitgedacht trial varied from 258 % for the Finnish Landrace x Merino to 155 % for the Cheviot x Merino. The average daily increase (A.D.G.) for the cross-bred lambs prior to weaning varied from 270 g for the Border Leicester and Bleu de Maine crossing to only 210 g for the Cheviot crossing. The A.D.G. from weaning to 12 months was 157 g for the Merino Landsheep crossing (the highest increase) and 136 for the Cheviot crossing (the lowest increase). It would appear that the Cheviot crossing is the poorest for these properties.

Wool production figures for this trial showed that the ram lambs sheared 14 % more wool than the ewe lambs at six months of growth. For this period the Border Leicester crossing produced 3,35 kg of raw wool as against 2,7 kg from the Cheviot crossing, the lowest production. The adult fleece masses again showed the Border Leicester crossing in the lead with 7,9 kg of raw wool, as

against the Finnish Landrace crossing, which produced 6,3 kg of raw wool.

The Japanese radish was investigated as a sheep feed at the Nooitgedacht Research Station, with or without hay supplements, and the findings were the following: Ewes that grazed radishes gained mass. Where ewes were fed radishes they lost mass slightly.

Lambs showed the following mass increases:

Method of feeding	100 days of corrected weaning mass (kg)	A.D.G. (g)
Grazed, without hay	32,0	270
Grazed, with hay	28,0	230
Lifted, without hay	21,0	160
Lifted, with hay	25,0	200

At 12 months of growth the groups that had access to grazing sheared 3,8 kg of wool on average, as against the 3,0 kg of the groups that were fed.

Dohne Merino wethers were used at Nooitgedacht to test harvested and unharvested soya-bean fields for the wintering of sheep. The harvested fields produced 167 grazing days per ha, with an A.D.G. of 17 g per sheep, as against the 1 509 grazing days per ha and 31 g increase per sheep on unharvested fields. The clean yield of the wool was only 54 %, however.

PELT SHEEP

In the **Free State Region** a comprehensive breeding trial with Karakul sheep showed progress with selection for four important pelt properties. The percentages by which progress in the fourth generation exceeded progress in the control were as follows for the four properties: curl type - 58 %, hair length - 28 %, pattern - 25 % and hair quality - 25 %. The results of the investigation also showed that there are relationships between hair length and pattern, hair quality and hair length, and curl type and pattern.

Progress has been made with selection for twins: a figure of 10 % is being obtained as against 4 % in the control group.

The project in which attempts are being made to develop a chocolate brown Karakul pelt with light golden or silver hair tips is already far advanced. It is clear at this stage that the highly heritable light hair tips are the most important factor in determining price. It has also been found that the mating of chocolate brown animals produces 50 to 60 % chocolate brown progeny.

In a sex physiological investigation with Karakul ewes attention is being given to the possibility of reducing the cost attached to hormone treatment for oestrus synchronisation. After a test with various concentrations of medroxy progesterone acetate, it was established that the use of less than 60 mg per application cannot be recommended.

A study of the sexual development of young Karakul rams born during the anoestrus period has



The Small Stock Museum at Grootfontein, under the auspices of the College's Scientific Association, is starting to take shape. This group of stuffed Angora goats was donated by the Mohair Board. The photograph shows Dr P.W. Roux (left), Director of the Karoo Region, and Mr David Uys, General Manager of the Mohair Board



The type of Dorper ram lamb being bred today has a longer body, is more muscular and has less fat and a better conformation than its predecessors of two decades ago. This lamb had a mass of 42 kg at 100 days of age

shown that live sperm cells appear in the ejaculate for the first time at the age of 120 days and at a body mass of about 38 kg.

Puberty in young Karakul ewes can possibly be advanced by oestrogen treatment.

Interesting results on the nutritive value of the natural grazing of the Orange River broken veld ("hard veld") and Kalahari duneveld ("soft veld") show that both veld types are able to satisfy the nutritional requirements of dry sheep in respect of crude protein and energy. This investigation shows that supplementary feeding practices on most farms are not based on a scientific foundation.

The Animal and Dairy Science Research Station is engaged in intensive genetic studies, to be followed up from the point of view of histology, in order to breed a pure white Karakul herd by means of crossings with the Gottland Landrace. Hair pattern and hair quality deteriorated greatly in the first crossings, but the carcasses of F₁ sheep slaughtered at 35 kg had improved considerably in comparison with the Karakul.

An investigation of hair sections and whole mounts of hairs showed that the fibres of the Gottland Landrace vary from intense pigmentation in some fibres to virtually no pigment in others. In the Karakul the hairs are either intensely pigmented or without any pigment - there are no variations in between. Whereas the thin fibres are round in the Gottlander x Karakul, the thick fibres show greatly flattened contours.

ANGORA GOATS

It was found in the Karoo Region that many of the problems of the mohair industry centre in practice around the Angora goat's sensitivity to changes in energy status. It was found, for instance, that an energy deficiency resulted in an average drop of 28 % in the blood glucose concentration. On the other hand, the blood glucose concentration rose by 57 % when the level of energy feeding was changed from below maintenance to above maintenance. These aspects are especially important during mating, in order to improve reproduction, and in pregnancy, to limit abortions. In addition, the energy status of the goat plays a major part in losses during wet and cold conditions.

Research is being concentrated at present on providing effective and practicable methods of boosting the energy status of the animal fairly rapidly. So far the best results have been obtained with caustic soda-treated maize, which raised the blood glucose concentration by about 50 % without the danger of digestive upsets.

Research on the use of hormones for the artificial improvement of reproduction has shown that breeding percentages of about 150 % can be obtained, without any danger of adverse effects. These techniques are being applied in practice on a relatively large scale.

Investigations into feeding and management practices with the problem of coccidiosis in ram lambs have shown that this problem can largely be

prevented by the inclusion of monensin sodium in the ration of the animals. Extremely favourable comments on the efficiency of this method have been received from the industry.

It was also found in the course of a follow-up study that the inclusion of monensin sodium in the ration of ram lambs boosted hair production by about 15 %, while the cost of the treatment is relatively insignificant.

DAIRY CATTLE

Nutrition

An investigation into the nutritional value of caustic soda-treated wheat straw for lactating cows has been completed. With regard to the inclusion value of treated straw in the diets of dairy cows, it was found in this study that up to 60 per cent straw can be included without any harmful effect on feed intake, milk production and milk composition. A drastic increase in sodium and potassium excretion was noted and the risk of the dung of such animals causing brack problems in soils on which it lands will require further investigation.

Preliminary results at Potchefstroom indicate that the inclusion of sheep manure (20-50 per cent in the concentrate mixture, depending on the stage of lactation) can limit the voluntary intake of concentrates by dairy cows to a desirable level. This has the advantage that concentrates can be made available to group-fed dairy cows at an *ad lib* level during the entire period of lactation. The roughage:concentrate ratios at 20 %, 30 %, 40 % and 50 % sheep manure levels were 41:59, 45:55, 60:40 and 74:26, respectively.

The potential of various ration combinations (consisting of soya-meal, whey powder and colostrum) for rearing dairy calves successfully and reducing pre-weaning rearing costs was investigated at Potchefstroom. It would appear that various ration combinations of soya-meal, whey powder and colostrum (depending on what is available) can be successfully used for the pre-weaning rearing of dairy calves, provided that a calf starter meal is also made available. Pre-weaning costs were 60 to 76 per cent lower than where full-cream milk was used.

Experimental data of the past year at the **Bethlehem** Research Station have shown that small grain pastures (rye and oats) grown on dry land can be economically used in feeding programmes for dairy cows. Correct management is a pre-requisite, however.

Dairy herds

The average milk production of 31 registered Frisians at the **Elsenburg** College of Agriculture for which official records were received was 5419 kg (lactation periods of 300 days), with butterfat and protein contents of 3,80 % and 3,30 % respectively. All three properties were better (8,0 %;

7,0 % and 0,9 %, respectively) than the figures made available for the Western Cape area as a whole.

Twenty-one registered Jerseys completed their lactations during the past year, with an average milk production of 3916 kg, the butterfat and protein contents of which were 4,85 % and 4,01 %, respectively. With the Jerseys these properties also showed an improvement (14,8 %, 2,1 % and 3,6 % higher) on the averages supplied for the Western Cape area.

According to the 1978/79 National Milk Recording Scheme results, when the average productions of grade Frisian herds (with over 19 cows and 2x milking) are compared, the Frisian herd of the Animal and Dairy Science Research Institute holds fourth place in the Transvaal at present.

Technical extension and advice

Technical extension and training on milk production and dairying continued to be an important activity. The annual dairy cattle farmers' days at Elsenburg and Outeniqua were attended by about 250 interested persons (Elsenburg: 200, Outeniqua: 50). Practical management problems of the dairy farmer were the theme and the papers delivered were of the highest standard, without exception.

The Dairy Industry Liaison Committee again rendered an important service to the dairy industry during the past year through the identification of problems and the meaningful dissemination of available knowledge. The above-mentioned dairy farmers' days were one of the results of action taken by the liaison committee.

MISCELLANEOUS

Hides and leather quality

During the past five years the Animal and Dairy Science Research Institute and the Leather Industry Research Institute co-operated closely in order to evaluate the physical properties of tanned upper leather for the footwear industry. This leather is manufactured from hides derived from cattle breeding and production experiments. The effect of biological properties of the animal, such as the breed, sex and age, on the physical properties of tanned leather was clearly evident from this work. An increase in extension force, force at break and slit tear force takes place with an increase in age, and at the same time a decrease in elasticity is observed. Africander cattle produced heavier hides than Frisians fed in the same way and slaughtered at the same ages. On the other hand the physical strength of the hides of Frisians was better than in the case of Africanders.

The connective tissue proteins in hides and in muscles are clearly correlated, since the meat of Africanders was tenderer than that of Frisians. The older the animals become, the tougher the meat and, as was found, the stronger the leather. Bull meat was tougher than meat from oxen and the leather

obtained from bulls was also stronger. Changes in connective tissue in hides are therefore closely related to those in muscle connective tissue. These results could give rise to a more accurate classification in the tanning industry of hides earmarked for specific purposes.

Ostriches

The Animal and Dairy Science Research Institute was approached by an interested body and asked to do comparative tests between two types of ostrich meat. One type of meat is already being exported in accordance with certain specifications, and it is intended to export the other type of meat as well.

Tests showed that thawing loss was lower in the type it is intended to export than in the type already being exported, which is an indication of better water fixing properties in the first type. A major problem with the export meat was a very high thawing loss of 32 %.

The quality characteristics and economic importance of white ostrich feathers were investigated at **Oudtshoorn**. The investigation showed that price differences are far more closely linked to actual differences in quality than to fashion trends.

The producer price for ostrich skins is determined on the basis of raw skin area. It has now been found that there is a very close connection between live mass and raw skin area. Raw skin area can therefore be reliably determined by measuring the mass of the live slaughter ostrich.

HORSES

For many local and overseas tourists a visit to the Percheron stable at Elsenburg was again the highlight of their programme. The use of draught-horses on farms increased rapidly. A shortage of good quality breeding mares was one of the factors that put a break on rapid expansion and a big demand for mares arose. At the annual stud auction R1 400 was paid for an adult mare, and a stallion was sold for R1 500.

During the year under review 10 foals were born in a stud, all of which are still alive - a remarkable achievement. The figure of 29 farmers' mares covered is almost three times as high as the average for the past 10 years.

SUPPORTING RESEARCH

A comprehensive research programme on the efficiency of feed consumption by farm animals is in progress at the Animal and Dairy Science Research Institute. It has already become clear that an animal's response to a particular feeding programme is very strongly influenced by his previous history. This knowledge is extremely important in explaining differences between animals, e.g. in feedlots or during performance testing.

Work on compensatory growth in livestock has shown that an animal requires the same quantity of food to attain a certain mass, irrespective of whether he grows fast or slowly. The practical implications are that livestock producers can develop strategic feeding programmes according to which the feeding level can be raised or reduced, depending on the availability of relatively cheap feed.

DAIRYING

Milk

The purchase of milk on the basis of fat and protein content, particularly for the dairy product industry, underwent further investigation with regard to the relationship of these constituents to the yield value and product yields. It was shown that the combined variations in fat and proteins in 95 % of cases provided a direct reflection of variations in the total milk solids and total solids yield of the manufactured dairy products. Owing to the small variations in the lactose content, their effect on the yield value of milk is insignificant.

Five strains of *Lactobacillus bulgaricus* were investigated for possible use in the preparation of yoghurt. Morphological, physiological and biochemical properties were determined. The cell-wall composition and sensitivity to antibiotics were also determined.

The presence of rancidity in milk as a result of fat hydrolysis is closely related to the type of milking plant on farms. The Bodmin Nu-Pulse claw extracts milk efficiently but has the disadvantage that it makes the milk rancid.

Rancidity in milk impairs the accuracy of fat determination by the infrared method, as does the milk acid composition. The replacement of Kjeldahl's method with the amido black method of protein determination as a standard for setting the infrared equipment gives a better indication of the true protein content of milk.

A suitable preservative for composite milk samples that have to be transported over long distances is being investigated, since the present preparations do not give satisfactory results. An investigation of the hygienic condition of milk tankers revealed that 61 % of the tankers exceed the accepted standard of 1 500 bacteria per 100 cm².

Cheese

The increasing use of phage-resistant starter cultures has resulted in fewer problems with cheese manufacture being experienced. Researchers are now tending to concentrate on whey utilisation instead. The addition of denatured whey proteins to cheese produced 5 % to 8 % higher yields, mainly as a result of higher moisture fixing properties. The higher yields were, however, accompanied by a reduction in the organoleptic quality. This aspect is undergoing further investigation.

The reclamation of undenatured whey proteins by ultrafiltration and denatured whey

proteins by means of centrifugation and decanting processes shows that the latter hold great economic advantages. Special apparatus developed by the Institute for this purpose has shown a reclamation in excess of 90 %, expressed in terms of real protein content. Other uses for whey proteins, e.g. as a replacement for sodium caseinate for use in the meat industry, in low-fat butter, coffee creamers, etc., are being investigated. The nutritional value is also being investigated. Several whey drinks and drinks containing whey have been developed. Whey milk, as it is known, holds considerable possibilities here and can be manufactured at low cost.

The manufacture of cheese by means of pre-concentration with the aid of ultrafiltration has the advantage of a faster manufacturing procedure and higher yields as a result of the inclusion of whey proteins. Feta cheese was successfully manufactured in this way and the yield was boosted from 13,8 kg per 100 kg of milk to 18,2 kg.

The activity of bacteria required for the manufacture of cheese and fermented products is sometimes inhibited by antibiotics and bacteriophage. To solve this problem resistant starter bacteria are being cultured and their suitability in the manufacture of dairy products tested.

Butter

A recent development in cultured butter production is that culture is being added to the churned butter at the salting stage instead of culturing the cream. In order to achieve the desired flavour in the product, the initial moisture content in the churned butter should be between 12 % and 13 %, so that sufficient culture can be added. It was found that although slightly lower moisture contents were obtained, there was greater fat loss in the buttermilk (2,51 % as against 1,4 %). The advantage is that elaborate cooling facilities for the cream are no longer required and that the buttermilk from this process is sweet and therefore of better quality for powder production than cultured cream butter.

Further investigation into the production methods of low fat butter spreads were carried out, resulting in an acceptable product which will probably be introduced to the South African market in the near future. This product has excellent spreadability at refrigerator temperatures, low calorific value and a higher protein content than normal butter. The composition of this product in comparison to that of normal butter is as follows:

Constituent	Butter	Butter spread
Fat	80-81 %	40-41 %
Protein	0,7 %	3,25 %
Lactose	0,9 %	3,33 %
Salt	1,5-1,8 %	1,40 %
Water	16,0 %	51,3 %

Concentrated milk products

After the way had been paved by research work, spray-dried instant whey milk powder was successfully manufactured on a commercial scale. A good quality product was manufactured.

A survey on antibiotic residues in milk and milk powders showed that a fairly high percentage occurs in pasteurised milk but considerably less in industrial milk and milk powder. Tests for antibiotics, which will also form part of a milk quality scheme, are recommended. Pre-heating of milk for milk powder production is considered essential to prevent the presence of bacteria that cause food poisoning. A survey of milk powders in South Africa showed that milk powders in general are of high quality. No *Salmonellae* were found in any product.

DAIRY AUXILIARY SERVICES

Quality improvement laboratory

During the past year the following products underwent chemical and bacteriological analysis:

Product	Number of samples
1. Pasteurised and raw milk	700
2. Yoghurt	260
3. Cottage cheese	150
4. Sour milk drinks	74
5. Butter	800
6. Ultra-high temperature-treated milk (UHT)	650
7. Milk powder	50
8. Cheese	160
9. Cream	30
10. Ice cream	30

The poor quality of raw milk is the biggest reason why pasteurised milk cannot comply with the actual bacteriological requirements. The bacteriological quality of yoghurt was good whereas the quality and keeping quality of cottage cheese and dairy drinks was poor as a result of a high contaminative bacteria content.

Downgradings of butter were due chiefly to oxidative defects, and high acid number values also occurred as a result of hydrolysis of the fats. When received ultra-high temperature-treated milk was of good quality, but some samples developed bitter and acid flavours during the keeping quality tests. Milk powders were of a high standard, cheese complied with the legal chemical requirements but high coliform and contaminative organism counts were found in some samples.

Extension to the industry

Extension work was carried out on a regular basis on the premises of milk producers and at dairy product factories and creameries. Methods

for setting an infrared analyser underwent further refinement at the milk testing laboratory at Elsenburg. This laboratory now serves as a central point for control and standardisation for State and private bodies.

In the course of extension to milk producers several farmers' days were held and visits were paid in connection with the quality of milk, milking machines, cold storage, cleansing, etc.

The Animal and Dairy Science Research Institute is concerned in the planning of four main projects for the dairy industry, namely:

1. a central whey utilisation plant involving several cheese factories;
2. the installation of a milk powder plant;
3. the re-organisation of the manufacturing procedure at a creamery; and
4. the development and standardisation of milk drinks for schools.

A variety of dairy products underwent chemical and bacteriological investigation followed by manufacturing flow studies to determine sources and points of infection.

Training dairy technologists

Technologists for the dairy industry are trained at Glen College of Agriculture. Twenty-two students enrolled for the introductory course in dairy technology.

Short courses in dairying

The following short courses in dairying were presented by the Glen College of Agriculture:

Course	Date	Number of students
Milko-tester	23-27 April 1979	5
Milko-tester and milk testing	1- 8 May 1979	8
Milk grading	18-29 June 1979	8
Milk grading	3-14 March 1980	7
Milko-tester	24-28 March 1980	4

LIVESTOCK AND PASTORAL PRODUCTS IMPROVEMENT SCHEMES

NATIONAL DAIRY CATTLE PERFORMANCE AND PROGENY TESTING SCHEME

A. Dairy cattle performance testing scheme

The scheme grew at a satisfactory rate during the year under review. The number of herds undergoing testing increased from 1092 to 1116. The number of milk samples tested increased by 89 969 (18 %) and the average number of cows

tested per month was 60 306, as against 56 586 the previous year.

Control testing for reliability of milk recorders, owner sampling and central laboratories was intensified and 842 twenty-four hour control tests were carried out, involving 22 633 cows. This intensification of control testing was necessary for several reasons; *inter alia* it made it possible to certify as correct the large number (17) of national milk records set during the year. Protein production is also used as a criterion in determining milk records.

B. Dairy cattle progeny testing scheme

During the year under review 215 young bulls were nominated for testing, 92 were found acceptable by the committee responsible and 19 were purchased for testing by AI organisations. The semen of 24 Frisian and three Jersey bulls was distributed to 274 Frisian herds and 62 Jersey herds.

Size of testing programme		
Breed	Number of herds	Number of test cows
Frisian	215	10 570
Jersey	57	1 790
Ayrshire	18	720
Guernsey	26	1 106
Total	316	14 186

Publications

The following publications appeared during the year under review:

- 1. Lifetime performances 1978/79, Part 3.
- 2. Official bull analyses, Part 7.
- 3. Annual Report 1978/79, Part II.

NATIONAL BEEF CATTLE PERFORMANCE AND PROGENY TESTING SCHEME

The beef industry showed signs of recovery during the past year, following better prices for good quality stud stock, easier access to abattoirs and higher meat prices.

The performance testing scheme continued to expand. There are now 1 242 breeders participating in the scheme - an increase of 96 as against the previous year.

The number of mass determinations increased by 6 098, despite the droughts in certain parts of the country. (See Table 1).

There has been a systematic increase in the number of bulls offered for sale at auctions with performance test data. The number of bulls subjected to growth tests during 1979 increased by 159, to 2 848. The number of bulls tested at the various testing centres is shown in Table 2.

TABLE 2

	Bulls tested	
	1978	1979
1. Departmental centres:		
Irene	233	305
Vryburg	263	275
Queenstown	159	149
Cedara	149	166
Omatjenne (SWA)	18	25
2. Non-Departmental centres:		
Potgietersrus	117	141
3. On-the-farm tests:		
Republic	1 562	1 668
SWA	158	119
Total	2 659	2 848

Five progeny groups were subjected to carcase evaluation during the past year. Significant differences were found between progeny groups for several carcase characteristics.

PERFORMANCE TESTING OF WOOLLED SHEEP

During the year under review 21 772 wool samples were analysed. Performance testing is becoming an increasingly important part of woolled sheep breeding. Increasing numbers of rams are offered for sale at auctions together with performance test data.

Further refinements were introduced into the computer programme and this year compressibility was included in the measurements taken. These expansions to the scheme are accompanied by a comprehensive extension service to breeders.

TABLE 1 - Number of members and masses recorded, 1979/80

Region	Members		Masses determined	
	1978/79	1979/80	1978/79	1979/80
Transvaal	329	347	91 849	95 986
Natal	195	245	55 545	61 253
South West Africa	149	143	51 754	45 614
Northern Cape	193	225	49 421	51 380
Eastern Cape	160	154	32 496	32 347
Free State	102	111	16 359	18 014
Western Cape	18	7	2 357	1 285
Total	1 146	1 242	299 781	305 879

MUTTON SHEEP PERFORMANCE TESTING SCHEME

Data on 11 554 lambs, derived from 120 breeders, were received and processed in 1979/80.

TABLE 3 shows the numbers of the various breeds and the number of breeders

Breed	Ram lambs	Ewe lambs	Breeders
Corriedale	230	177	1
Dormer	909	897	14
Dorper	1 250	1 361	28
Hampshire	63	48	2
Ile de France	199	244	7
Kaffrarian			
Polled Merino	91	123	1
Letelle type	212	251	1
Merino Landsheep	88	86	6
Poll Dorset			
Horn	34	70	3
SA Mutton Merino	1 924	2 030	42
Suffolk	326	302	5
Improved Boer Goat	207	175	6
Walrich	133	144	4
Total	5 666	5 908	120

NATIONAL PIG PERFORMANCE AND PROGENY TESTING SCHEME

The pig recording and health phase

The membership of the Pig Performance and Progeny Testing Scheme has remained unchanged (47) since 1978. However, the number of litters recorded increased from 3 824 to 3 877. This increase is due largely to the increase in the number of Large White litters. The number of litters recorded could increase still further, since data from certain breeders are still outstanding.

Boar and sow performance testing phase

Table 4 shows the number of pigs tested at the three centres in 1979.

The number of boars tested during 1979 was about 26 % higher than in 1978. The number of S.A. Landrace boars tested increased by 8,8 %, and Large White testing increased by 70,8 %. However, this figure reflects the demand for good Large White boars.

Since the testing facilities at the various testing centres are very limited and the testing of boars has become very popular, sow testing has been neglected and has declined by 57 %.

Progeny testing

The number of progenies tested in 1979 was 50 % lower than the previous year. This drop may be ascribed to the excessively high prices obtained for boars at the various auctions held. For this reason breeders were more inclined to obtain as many tested boars as possible during the year rather than have progeny tested.

Test results

Table 5 shows the average boar performances recorded at the three testing centres. An improvement in performance was obtained with age (up to 86 kg) and feed conversion ratio, and the C + K fat measurements increased by 2 mm. This increase may be the result of the fact that about 25 % of the boars tested at Elsenburg were disqualified in the stress sensitivity test. The thinner pigs were more inclined to show stress. In addition the feed conversion figure improved a great deal, namely from 2,77 in 1978 to 2,64 in 1979 at Elsenburg.

In general, performance testing showed that systematic genetic improvement in South African herds can be brought about by testing.

POULTRY PERFORMANCE TESTING

Egg production tests

At the conclusion of the fourteenth random sampling egg production test at Glen a hen-housed average of 255,6 eggs per hen, was obtained and during the ninth test at Irene a hen-housed average of 249,8 eggs per hen up to an age of 504 days was obtained. These production figures were considerably higher than those of the previous year. One overseas participant entered.

Broiler tests

In a random sampling broiler test held at Irene the average mass of the chicks was 2,095 kg at eight weeks. One overseas breeder entered.

Poultry multiplication scheme

During the year one firm imported laying breed breeding material. There is still a regular demand for hatching eggs of the imported breeding material. Eggs are also supplied to Onderstepoort for vaccine production.

ANIMAL HEALTH VETERINARY RESEARCH INSTITUTE

Research, vaccine production and the specialised diagnostic functions of the Institute proceeded normally during the year since there were no unexpected outbreaks of stock disease which might dramatically have affected these activities. The new foot-and-mouth disease laboratory, which was opened recently, added a new dimension to activities at Onderstepoort and required considerable attention.

The existing research programmes were pursued. Seven new projects were registered during the year, 13 were finalised and closed and 1 was suspended. There are 138 current projects. A total of 52 scientific articles were published during the

TABLE 4 - Number of pigs tested

		Cedara		Elsenburg		Irene		Total	
		1978	1979	1978	1979	1978	1979	1978	1979
Boars	S.A.L.	171	245	361	331	358	392	890	968
	L.W.	74	91	149	259	126	246	349	596
	Total	245	336	510	590	484	638	1 239	1 564
Sows	S.A.L.	84	30	-	-	66	13	150	43
	L.W.	43	13	-	-	17	34	60	47
	Total	127	43	-	-	83	47	210	90
Pro-geny	S.A.L.	-	-	-	-	62	26	62	26
	L.W.	-	-	-	-	60	40	60	40
	Total	-	-	-	-	122	66	122	66
Total		372	379	510	590	689	751	1 571	1 720

TABLE 5 - Average boar performance

		Age		F.C.R.		C+K		A.D.G.	
		1978	1979	1978	1979	1978	1979	1978	1979
<i>Elsenburg</i>									
S.A.L.		141	138	2,85	2,73	30	33	0,88	0,91
L.W.		139	135	2,69	2,54	31	32	0,92	0,97
Average		140	137	2,77	2,64	31	33	0,90	0,94
<i>Cedara</i>									
S.A.L.		142	140	2,80	2,72	30	40	0,93	0,89
L.W.		138	135	2,80	2,72	39	40	0,93	0,95
Average		140	138	2,87	2,80	39	40	0,91	0,92
<i>Irene</i>									
S.A.L.		143	139	2,78	2,75	39	39	0,88	0,92
L.W.		137	139	2,56	2,58	37	35	0,93	0,94
Average		140	139	2,67	2,67	38	37	0,91	0,92
<i>R.S.A.</i>									
S.A.L.		142	139	2,84	2,79	35	37	0,88	0,95
L.W.		138	136	2,67	2,61	35	36	0,93	0,95
Average		140	138	2,76	2,70	35	37	0,91	0,95

year.

The research projects on the causes of tribulosis (geeldikkop) and jaagsiekte have made good progress and are being currently pursued, as is research on the epidemiology of African swine fever. Advances are being made with the development of a vaccine against the turkey sinusitis virus that was discovered last year.

Research on ticks and tick-borne diseases of ruminants is also making good progress. Intracellular rickettsiae, which are possibly related to the cause of the disease, have been found in the ovaries of a strain of the bontlegged tick that causes sweating sickness. Studies on the epidemiology of redwater and the immunology of heartwater are proceeding well and new tick vectors of anaplasmosis have been discovered.

Sophisticated surgical methods and treatment with certain hormones have shed new light on the causes of infertility in rams with epididymitis.

Various new or improved vaccines were released during the year. The triple-inoculation bluetongue vaccine is a big improvement on the old one and, if properly used, it should reduce the disease to the level of a minor one. The new cell-culture rabies vaccine is also much more useful than the former egg vaccine. A *Staphylococcus* vaccine aimed at the commonest forms of mastitis has recently been released.

Much attention is being paid to the diagnosis of the infectious causes of infertility in ruminants, as in the past, and extension services on the prevention of mastitis in dairy cows have been given high priority.

VETERINARY RESEARCH

DISEASES OF CATTLE

Bacterial diseases

Six different vaccines against brucellosis were compared experimentally. It was concluded that live vaccines, which include Onderstepoort's Strain 19 vaccine, provide much better protection than inactivated vaccines.

Diagnostic investigations have confirmed that *Salmonella dublin* again caused many more cases of paratyphoid in calves than any of the other species which have so far been isolated.

Protozoal diseases

The project dealing with the epidemiology of the tick-borne disease, redwater, continues to make good headway. It was also considerably extended

and now includes the western areas of the Cape, the Transvaal bushveld and parts of Natal. It is noteworthy that an enzootically stable situation with regard to *Babesia bigemina* (African redwater) occurs in the arid sweet bushveld of the Transvaal, while *B. bovis* (Asiatic redwater) is completely absent. On the other hand, there are some farms along the coastal areas of the Western Province where the situation is stable regarding both types of redwater. In those parts of Natal that were tested, *B. bovis* was either absent or rare, but most farms were unstable for *B. bigemina*. Dipping without the concomitant use of vaccines is largely responsible for this invidious position.

Studies on the transmission of anaplasmosis have revealed that the three-host tick *Rhipicephalus simus* may act as vector of the disease. The infection is transmitted transstadially but not transovarially. The same applies to the blue tick *B. microplus*, but since this is a one-host species, the practical significance of this finding is not clear. Anaplasmosis was also mechanically transmitted by stable flies *Stomoxys calcitrans* from an infected to a susceptible animal. Attempts to transmit the disease by cattle louseflies *Hippobosca rufipes* were unsuccessful.

Infertility and venereal diseases

As part of the survey on the causes of abortion, bovine foetuses and afterbirths were examined for pathogenic micro-organisms. The following table is a summary of the findings:

	% of farm infected	
	1978/79	1979/80
Brucellosis	14,5	12,1
Q fever	2,9	0
Campylobacteriosis (=vibriosis)	2,9	0,8
Chlamydiosis	5,9	6,4
<i>Corynebacterium pyogenes</i>	1,7	7,2
<i>Salmonella dublin</i>	n.e.*	0,8
<i>Pasteurella haemolytica</i>	n.e.	0,8

*n.e. = not examined

The success rate with foetal diagnosis is still low (29 %).

Of the 1470 sheath washings of privately owned bulls examined, 63 (4,4 %) were positive for vibriosis, and 92 (6,2 %) for trichomoniasis. Of the mucus specimens of 167 cows examined, 3 (1,8 %) were positive for vibriosis, 2 (1,2 %) for trichomoniasis, 2 (1,2 %) for brucellosis and 2 (1,2 %) for *C. pyogenes*. Cervical biopsies were more valuable for diagnosing vibriosis than vaginal mucus.

During the year, 23 660 sera were examined by means of the Rose Bengal, serum agglutination and complement fixation tests. The results showed that 5,7 % of these sera were positive for brucellosis compared with 8,8 % in 1978/79. In a restricted trial it was established that at least 10 % of the cows that had been immunised with Strain 19

vaccine as adults had *Brucella* in vaginal discharges after challenge with virulent *Brucella*.

External parasites

Further progress was made with research on blackflies (*Simulium* spp.). Vast numbers of eggs of *S. chutteri*, the problem species in the North-Western Cape, were found in silt in the Vaal River near Warrenton. These eggs appeared to be in a latent phase and, when conditions are favourable for them to hatch, may produce a new plague of midges. Research on the effectiveness of manipulating the water-level for the control of *Simulium* is proceeding.

All attempts to find a toxin responsible for sweating sickness in the saliva of *Hyalomma truncatum*, the tick vector, failed. A particularly interesting finding, however, was the presence of intracellular rickettsiae in the ovaries of the strain of ticks that cause sweating sickness. These organisms were absent in a non-sweating sickness strain of this tick species that was examined.

The survey on the resistance of ticks to dipping fluids was continued. No new tendencies of any significance have been observed.

Attempts to use suspensions of infected bont tick nymphae as a vaccine against heartwater are being thwarted by the variable nature of the infectivity of these suspensions. It has been established that standard methods of freezing can be used to preserve the suspensions. Contrary to what has hitherto been accepted, it has been discovered that heartwater is sometimes transmitted transovarially to the progeny of female ticks. Studies on the immunology of heartwater continue.

Internal parasites

The *Parafilaria* survey was extended to determine the situation in the Eastern and Western Cape. It was found that parafilariosis is widespread in the Eastern Cape, especially in the thornveld and valley bushveld areas. A survey carried out at the Cape Town abattoir showed that parafilariosis is also present in South-West Africa/Namibia, but not even in the northern parts is it common.

Poisoning

It is clear from specimens submitted to Onderstepoort for analysis that poisoning with pesticides remains one of the most important causes of mortality among animals.

If strychnine poisoning of dogs and cats is left out of account, approximately 50 % of all the cases of poisoning investigated at Onderstepoort this year may be ascribed to organic insecticides. Parathion, endosulfan and dieldrin, in that order, were responsible for the majority of cases of poisoning with organic insecticides. Urea also took its usual toll. Most of these losses are the result of injudicious or careless exposure of cattle to these

poisons. Plant poisoning is also common, though cases are seldom referred to Onderstepoort.

Chronic *Aspergillus clavatus* poisoning was diagnosed in dairy cows fed mouldy predigested dregs of sorghum used in the manufacture of beer. In these cases the mycotoxicosis was characterised by a dramatic drop in milk production in the herd, poor appetite and loss of weight. Only a few individuals showed the more characteristic tremors of the acute syndrome.

DISEASES OF SHEEP AND GOATS

Bacterial diseases

Observations on 100 rams suffering from epididymitis showed that a wide range of bacteria that occur free in the environment are able to enter from outside and penetrate deep into the genital tract. Of these organisms *Pasteurella haemolytica* was the commonest. In another investigation it was found that, by treating rams with certain hormones, some of these organisms can be induced to migrate from the sheath deep into the genital system. These findings offer an explanation for the cause of this serious problem in rams.

It was established experimentally that immunity to *Pasteurella multocida* types A and D is extremely strain-specific. The practical significance of this finding is that it would be extremely difficult to prepare a vaccine that would provide protection against pasteurellosis in all parts of the country. An examination of specimens showed that *P. haemolytica* and *P. multocida* are still a common cause of pneumonia.

Tests on the development of a vaccine against "redgut" in sheep were continued. The results obtained in rabbits with an alum-adjuvant vaccine are promising, but no meaningful deductions can yet be made from tests being carried out on sheep under field conditions. Observations are proceeding.

Reports have been received from the field of breakdowns in immunity to pulpy kidney in sheep that had been inoculated against the disease as lambs. Controlled tests have established that young lambs react poorly to inoculation. This problem, however, can be solved if the lambs are injected with oil adjuvant followed by the alum-precipitated pulpy kidney vaccine.

Viral diseases

A haemagglutination-inhibition test has been developed for the serological diagnosis of bluetongue. This test provides a less laborious method of sorting out the great variety of bluetongue serotypes.

Good progress has been made with research on jaagsiekte. Following genetic recombination, a new type of retrovirus has been successfully demonstrated in jaagsiekte cancer tissue. Attempts are now being made to induce jaagsiekte in sheep with this virus.

Protozoal diseases

Three remedies, namely, amprolium, lasalocid and monensin, were tested againsts coccidiosis in naturally-infected goats. The results show that all three remedies have an inhibitive effect on the parasites, though, in the case of amprolium, the recommended dose must be doubled to produce the desired result. Lasalocid produced the best results in young goats if both increase in weight and oocyst counts are used as criteria.

Infertility and venereal disease

Further examinations of fetuses and afterbirths for pathogenic micro-organisms are being carried out.

	% of farms affected	
	1978/79	1979/80
Ovine chlamydiosis	16,8	17,6
Q-fever	3,9	2,9
<i>Brucella</i>	n.e.	1,4
<i>Corynebacterium ovis</i>	n.e.*	7,3
<i>Actinobacillus seminis</i>	n.e.	1,4

*n.e. = not examined

Internal parasites

A strain *Haemonchus contortus* that is slightly resistant to rafoxanide has been isolated. This is apparently the first record of resistance in *H. contortus* to this remedy or group of remedies.

The long-term preservation of various worm species in the gas phase of liquid nitrogen at extremely low temperatures is now a decided possibility. Furthermore, an agar gel technique has been developed for the recovery of adult worms and larvae from the total ingesta of large numbers of sheep.

Poisoning

Tribulosis (geeldikkop) is still being studied. The so-called cholesterol-like crystals, which apparently clog the bile ducts and consequently play an extremely important role in the pathogenesis of the disease, have been observed for the first time with the aid of the scanning electron microscope. An interesting observation is that the toxicity within a consignment of dubbeltjies *Tribulus terrestris* collected on a single farm can apparently vary considerably in its ability to induce tribulosis.

DISEASES OF PIGS

Bacterial diseases

The occurrence of erysipelas in pigs has stimulated attempts, which have proved successful, to develop a vaccine against the disease. All tests on the vaccine had to be carried out on mice, since it is difficult to infect pigs artificially. The vaccine will shortly be released.

Viral diseases

Further good results have been obtained from research on the epidemiology of swine fever. Young warthogs that were artificially infected with the virus showed no symptoms of the disease. Nevertheless, high concentrations of the virus were found in most organs, especially in lymphatic tissues where virus titres remained high for several weeks. Such tissues were also infective when fed to domestic pigs. Peak viraemia, at a level that was infective for tsetse flies *Ornithodoros*, was reached a week after infection. Studies on tsetse flies which had been collected from various parts of the country showed that there were very many more infected tsetse flies on farms in the Thabazimbi district than in the Mkuze Game Reserve, and that the highest incidence of infection occurred in the Kruger National Park.

A serious viral disease of pigs, characterised by encephalitis and myocarditis and accompanied by cardiac failure, was diagnosed for the first time in the Republic. Rats and mice act as carriers of the disease. An experimental vaccine which was developed controlled mortalities within a week.

Attempts are being made to develop a vaccine against parvovirus infection in sows. Preliminary results show that inactivation of the virus is difficult and that only pigs that have been inoculated with undiluted attenuated vaccine exhibit a satisfactory immune response.

DISEASES OF POULTRY

Mycoplasmal diseases

Serological surveys showed that *Mycoplasma synoviae* is one of the most important causes of respiratory disease in broilers and laying hens at present. While breeders keep their breeding flocks free of *M. gallisepticum*, this is not the case with *M. synoviae*, with the result that chickens originating from such flocks are also infected with the latter disease.

Viral diseases

The turkey sinusitis virus, which has been isolated in trachea-ring organ culture, has been successfully grown in the chorio-allantoic membrane of embryonated hen's eggs. A trial vaccine, which was made after 17 passages of the

virus in hen's eggs, has yielded promising results. The mortality among turkey chicks on an infected farm dropped from 30 % to 10 %. The latter figure is still slightly higher than the figure for non-infected flocks (6-8 %), and generation 19 will now be tested as an experimental vaccine.

Cases of Marek's disease are on the increase at present. This is apparently not due to a decrease in the effectivity of the vaccine, but rather to faulty inoculation procedures and poor management practices.

Infectious bursal disease (Gumboro disease) is becoming increasingly important in the broiler industry, not so much because of the effects of the disease itself, but because it suppresses the immune reaction of poultry against other diseases such as Newcastle disease, infectious bronchitis, necrotic enteritis and coccidiosis.

DISEASES OF HORSES

Protozoal diseases

Of the 209 horse specimens tested for dourine in the RSA during the year, 27 (1,3 %) were positive. Eleven of these cases occurred in the Transvaal, 4 in Natal, 3 in the Cape and 9 in the Orange Free State. Positive specimens were also received from the Transkei, South-West Africa/Namibia, Botswana and Zimbabwe.

DISEASES OF MISCELLANEOUS ANIMALS

Viral diseases

The new tissue culture vaccine which has been developed against rabies was released during the year. Since the vaccine can be produced more easily than the avianised vaccine used hitherto, Onderstepoort was able to meet the increased demand.

Of the 1 342 specimens tested during this year, 495 (36,9 %) were positive for rabies. Of these specimens 333 came from the RSA and 162 from South-West Africa/Namibia. The corresponding total figure for 1978/79 was 218 cases. The following table shows the distribution of the disease among the various hosts:

Cattle	146
Dogs	127
Domestic cats	14
Other farm animals	13
Yellow mongooses	49
Other mongooses	2
Wild cat species	5
Black-backed jackals	25
Other predators	56
Wild ruminants (kudu)	54
Humans	4

Rabies is increasing steadily among kudu in South-West Africa/Namibia. There were 25 cases in 1978/79 and 54 in 1979/80.

Parvovirus of dogs, which is the cause of an extremely serious disease of puppies, and which is spreading rapidly, has now been confirmed in the RSA as well. It has been established that the virus causes extensive heart lesions in these animals.

TECHNICAL RELATIONS WITH OTHER COUNTRIES

Liaison and co-operation with African countries

Six scientists from African countries, namely, Malawi, Zimbabwe and Kenya, visited the Institute during the year. Various neighbouring states and other countries received 13 664 473 doses of vaccine from Onderstepoort through official channels. Moreover, the Institute received 1 862 specimens for diagnosis from such countries as Botswana (213), France (2), Greece (9), Lesotho (48), Malawi (51), Mauritius (15), Oman (2), South-West Africa/Namibia (1 211), Swaziland (187), Zambia (22) and Zimbabwe (102).

Liaison with overseas countries

Thirty-one foreign scientists paid short visits to Onderstepoort during the year. In addition, 250 foreign tourists, in various groups, visited the Institute.

As the world reference centre for bluetongue, Onderstepoort was able to render valuable assistance to Italy, the United States, Greece and Germany with the diagnosis of bluetongue and the identification of strains which occur in some of those countries.

Overseas study tours

Five members of staff undertook short official study tours during the year.

VACCINES AND STOCK REMEDIES

VACCINE PRODUCTION

The demand for virus vaccines decreased slightly during the past year, probably owing to the fact that there were no major outbreaks of virus diseases. On the other hand there was an increase of 7,0% in the issues of bacterial vaccines, which can primarily be accounted for by the large orders that were placed by neighbouring countries. The biggest increase was in the issues of *Haemophilus* and *Pasteurella* vaccines (about 20%). A declining trend in issues of protozoal vaccines was again observed: 757 411 doses were issued in 1979/80 compared with 1 034 206 doses during 1976/77.

The following vaccines were supplied to foreign and neighbouring countries and constituted about 8% of the Institute's total production:

	Doses	
	1978/1979	1979/1980
Botswana	339 473	296 783
Lesotho	4 000	156
Malawi	120 000	172 600
Zimbabwe	1 635 848	3 840 668
Mauritius	3 000	-
Swaziland	78 430	400 455
Zambia	2 543 370	6 313 113
Transkei	110 467	62 277
Israel	910 000	1 232 500
South-West Africa	1 153 155	1 085 858
Bophuthatswana	-	34 023
Venda	-	25 040
Réunion	-	1 000
Mozambique	-	100 000
Total	6 897 743	13 564 473

Viral vaccines

The most important achievements of the past year were the release of the new bluetongue vaccine and a tissue culture rabies vaccine. The old bluetongue vaccine and the so-called supplementary vaccine were replaced by 3 separate vaccines which are inoculated consecutively. Although the new vaccine is more laborious to use, it induces a better immunity against the 15 virus strains it contains. The release of a tissue culture rabies vaccine is a further mark of the excellent progress made. The new product is far easier to produce and use, and it is suitable for all animal species. There was a distinct drop in the demand for Wesselsbron disease vaccine, but more than a twofold increase in the demand for ephemeral fever vaccine.

Bacterial vaccines

The combined botulism-quarter evil vaccine remained very popular and the Institute was unable to meet the demand in full. The rate of production has been increased, however, and the backlog is expected to be wiped out within a foreseeable period.

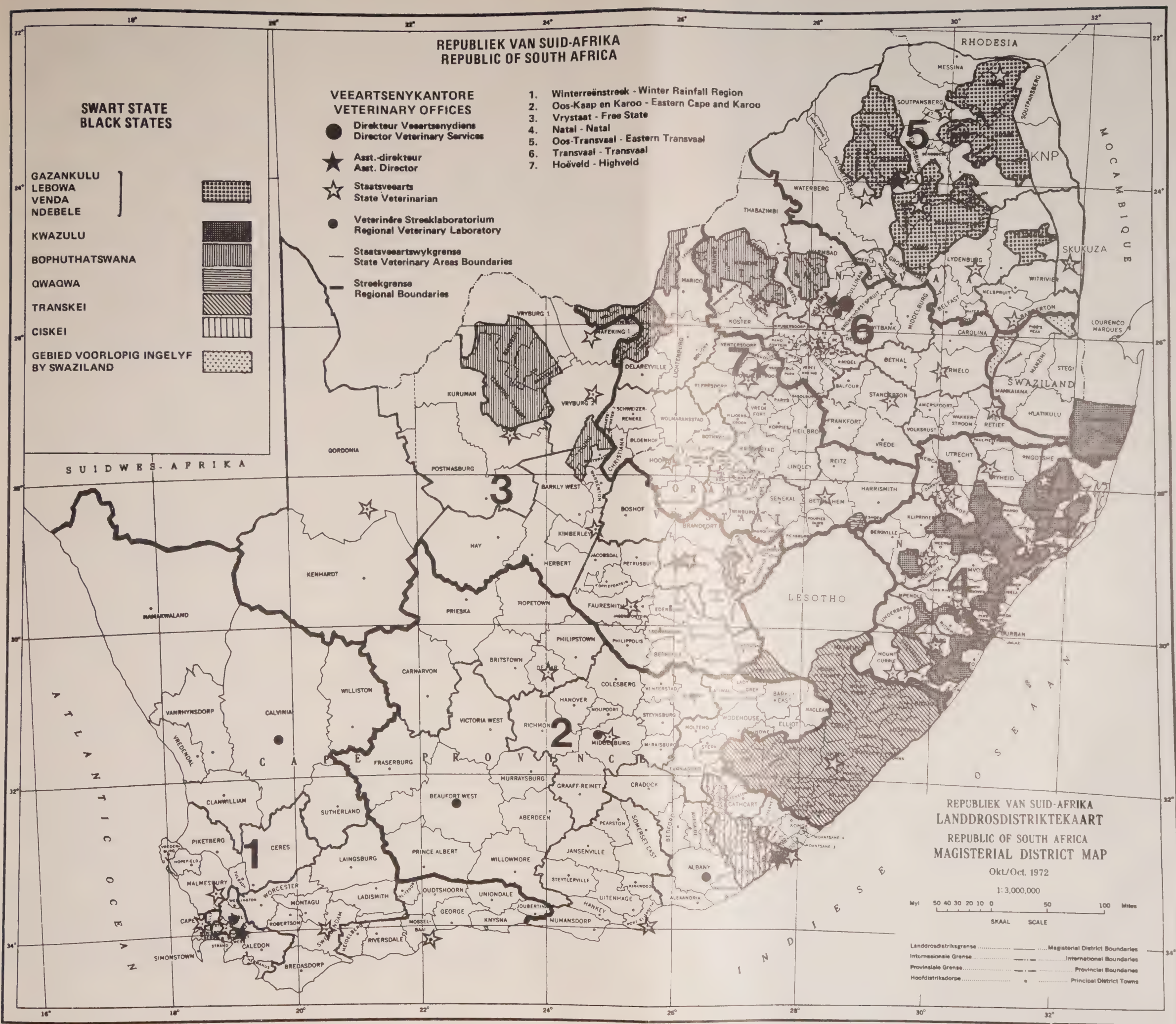
A vaccine against mastitis caused by *Staphylococcus* was released during the course of the year, but it is available only on prescription. The quality control of the *Brucella* vaccines has been improved and research is continuing on the improvement of the quality of the quarter-evil, *E. coli*, *Vibrio* and *Pasteurella* vaccines. The problems regarding the effective immunisation of young lambs against enterotoxaemia have also been solved.

Diagnostic reagents

There was a further decline in the demand for BWD antigen and a marked decline in the demand for avian tuberculin.

VACCINE SALES

Vaccine	Doses issued		
	1977/78	1978/79	1979/80
<i>Bacterial vaccines</i>			
Enterotoxaemia (oil) : (<i>Cl. perfringens</i> D)	11 741 100	9 992 900	9 895 400
Enterotoxaemia (alum) : (<i>Cl. perfringens</i> D)	30 021 800	30 105 400	31 291 600
Enterotoxaemia (total)	41 762 900	40 098 300	41 187 000
Lamb dysentery : (<i>Cl. perfringens</i> B)	280 500	246 500	186 950
<i>Brucella</i> S19 (cattle)	2 717 672	2 298 206	1 923 002
<i>Brucella</i> Rev 1 (sheep)	521 780	553 015	641 920
<i>Corynebacterium ovis</i>	138 060	133 010	236 040
<i>Corynebacterium pyogenes</i>	492 900	555 320	662 000
Swelled head in rams : (<i>Cl. novyi</i>)	143 800	150 450	113 850
Colibacillosis (cattle and sheep) : (<i>E. coli</i>)	80 860	74 810	85 560
Colibacillosis (pigs) : (<i>E. coli</i>)	260 220	244 060	270 650
Fowl typhoid : (<i>S. gallinarum</i>)	2 862 800	2 004 800	2 295 700
Botulism : (<i>Cl. botulinum</i> C & D)	5 234 910	5 110 715	7 219 875
<i>Clostridium septicum</i>	118 100	163 020	117 880
Bovine pleuropneumonia (CBPP) : (<i>M. mycoides</i>)	1 105 000	580 800	665 800
Anthrax : (<i>B. anthracis</i>)	18 286 430	14 415 030	16 421 950
Paratyphoid (live) : (<i>S. dublin</i>)	347 006	302 534	329 592
Paratyphoid (inactivated) : tri-valent	18 964	14 994	56 710
<i>Pasteurella</i> (sheep & cattle)	2 277 120	2 730 500	3 054 180
Black-quarter (quarter-evil) : (<i>Cl. chauvoei</i>)	10 101 794	7 973 682	7 220 036
Tetanus : (<i>Cl. tetani</i>)	161 230	159 320	174 080
<i>Vibrio fetus</i>	146 150	129 000	196 200
<i>Haemophilus coryza</i> : (<i>H. gallinarum</i>)	3 929 100	4 433 300	5 404 800
Combined black-quarter/Botulism	624 106	1 963 468	1 742 934
<i>Staphylococcus</i>	-	-	7 720
Total for bacterial vaccines	91 611 402	84 334 834	90 213 429
<i>Virus vaccines</i>			
Enzootic abortion : (<i>Chlamydia</i>)	3 010 400	3 032 700	3 141 300
Bluetongue	26 938 800	25 290 400	23 623 000
Pigeon pox	568 300	685 300	462 700
Fowl pox	4 242 600	3 595 000	2 925 200
Distemper	36 894	52 547	56 657
Rabies LEP (dogs)	253 827	254 050	-
Rabies HEP (cattle & cats)	27 359	41 996	-
Rabies : (Total)	281 186	296 046	484 538
Infectious bronchitis (poultry)	5 242 600	8 971 000	7 262 000
Infectious laryngotracheitis	11 762 000	9 858 000	10 357 000
Lumpy skin disease	2 305 005	1 544 610	1 307 530
Newcastle disease (Komarov)	18 122 200	12 037 500	14 267 500
Horsesickness	173 585	187 531	180 815
IBR : (Infectious bovine rhinotracheitis : live)	134 050	120 740	148 530
IBR : (inactivated)	-	-	1 700
Rift Valley fever (live) (sheep)	1 999 300	1 147 000	843 900
Rift Valley fever (inactivated) (cattle)	1 062 050	1 386 000	1 867 350
Wesselsbron disease	1 621 900	798 200	26 400
Ephemeral fever (three day stiffness)	351 575	51 790	117 356
Total for virus vaccines	78 254 945	69 054 464	67 073 476
<i>Protozoal and rickettsial vaccines</i>			
Anaplasmosis (gallsickness)	643 660	496 530	432 047
Heartwater blood	118 548	122 310	117 692
Redwater	104 185	124 145	125 357
Elephant skin disease (besnoitiosis)	104 110	71 570	82 315
Total for protozoal and rickettsial vaccines	970 503	814 555	757 411
Grand total for all vaccines (doses)	170 836 850	154 203 853	158 044 316
<i>Diagnostic aids (antigens) (in mμ)</i>			
BWD antigen : (<i>Salmonella gallinarum/pullorum</i>)	33 060	26 910	14 670
<i>Brucella abortus</i> antigen (SAT)	31 700	36 000	20 100
<i>Brucella</i> milk ring test antigen	1 540	1 280	1 500
<i>Brucella</i> Rose Bengal antigen	7 060	7 300	8 240
<i>Brucella</i> CF antigen	0	0	2 780
Tuberculin (bovine)	108 358	152 382	145 914
Tuberculin (avian)	37 020	109 250	50 270
<i>Mycoplasma gallisepticum</i> (CRD) antigen	4 410	2 980	2 110
Total for diagnostic antigens (mμ)	223 911	339 107	245 584
<i>Antisera (in ml)</i>			
Tetanus (<i>Cl. tetani</i>)			470
Botulism (<i>Cl. botulinum</i>)			890
<i>Brucella abortus</i> standard positive serum			27
Total for antisera (ml)			1 387



REPUBLIEK VAN SUID-AFRIKA
REPUBLIC OF SOUTH AFRICA

SWART STATE
BLACK STATES

- GAZANKULU
- LEBOWA
- VENDA
- NDEBELE
- KWAZULU
- BOPHUTHATSWANA
- OWAQWA
- TRANSKEI
- CISKEI
- GEBIED VOORLOPIG INGELYF BY SWAZILAND

VEEARTSENKANTORE
VETERINARY OFFICES

- Direkteur Veeartsenydiens
Director Veterinary Services
- ★ Asst.-direkteur
Asst. Director
- ☆ Staatsveearts
State Veterinarian
- Veterinêre Streeklaboratorium
Regional Veterinary Laboratory
- Staatsveeartswykgrense
State Veterinary Areas Boundaries
- Streekgrense
Regional Boundaries

1. Winterreënstreek - Winter Rainfall Region
2. Oos-Kaap en Karoo - Eastern Cape and Karoo
3. Vrystaat - Free State
4. Natal - Natal
5. Oos-Transvaal - Eastern Transvaal
6. Transvaal - Transvaal
7. Hoëveld - Highveld

REPUBLIEK VAN SUID-AFRIKA
LANDDROSDISTRIKTEKAART
REPUBLIC OF SOUTH AFRICA
MAGISTERIAL DISTRICT MAP

Ok./Oct. 1972

1:3,000,000

Myl 50 40 30 20 10 0 50 100 Miles
SKAAL SCALE

Landdrostdistriksgrense Magisterial District Boundaries
Internasionale Grense International Boundaries
Provinsiale Grense Provincial Boundaries
Hoofdistrikdorpe Principal District Towns

A new *Brucella abortus* antigen for use specifically for complement fixation tests was made available and it will gradually replace the SAT antigen.

DIVISION OF VETERINARY SERVICES

VETERINARY RESEARCH

Miscellaneous research projects

Officers of the Regional veterinary laboratories, the AI and Reproduction Section and the Poultry Diagnostic and Extension Services Section continued with valuable research work.

The AI and Reproduction Section has made a survey of bacterial contamination in semen straws. Techniques to improve hygiene when semen is collected are continually examined. This section is also participating in a project in which management problems are being studied in selected fresh milk herds.

The Poultry Diagnostic and Extension Services Section, in collaboration with scientists at Onderstepoort, continued with investigations into the cause of *dikkop* in broilers, and were able to isolate the virus of infectious bronchitis from a few cases.

Attention was also given to *ascites* or abdominal dropsy in broilers. It was found that the incidence was higher during winter than during summer. Ascites was induced in chicks by giving them salty water to drink. It appears that ascites is not caused by an infective agent but is rather the result of several factors such as stress, low temperatures, poor ventilation and toxins.

Infectious laryngotracheitis was also diagnosed on several poultry farms in the Transvaal and the Eastern Cape and Karoo Regions.

Photosensitivity in sheep was investigated by the Regional veterinary laboratory at Stellenbosch. The increase in the number of cases of this condition can possibly be attributed to more intensive farming practices and also to an increase in artificial pastures. Although most cases can be attributed to the ingestion of plants known to cause photosensitivity it is presumed that toxins from fungi also play a role. This so-called fungal photosensitivity usually occurs during the months of September and October.

There are indications that the Dormer is more susceptible than the South African Mutton Merino.

A condition in pigs known as *dimpled skin* was also investigated. Bilateral symmetrically disseminated dimples and an increase in the thickness of the layer of fat were noted in all typical cases. The only abnormal conditions that could be established were an abnormally hot summer, a partial interruption in the water supply for a period of two days, and a slower growth rate.

The mastitis control scheme was continued by the Regional veterinary laboratory at Allerton and 109 herds, comprising a total of 11 560 cows, are now participating in this scheme. Trials with *Staphylococcus aureus* toxoid vaccine were carried out on seven herds comprising a total of about 1 000 cows. Preliminary results indicate that there was a reduction in the incidence of *Staphylococcus mastitis* in these herds, and that clinical cases responded more favourably to medication. No cases of gangrenous mastitis were diagnosed in these herds. Considerable attention was also given to the identification of fungi and the building up of a collection of smears.

In conjunction with scientist from Onderstepoort and the Wool Board a trial was conducted by the Middelburg (CP) Regional veterinary laboratory with *Actinobacillus seminis* vaccine on a farm known to be infected. On account of the severe reactions caused by the vaccine the trial was discontinued. Extensive trials were conducted to determine the pathogenicity of the organism and the possibility of transmitting it to pregnant laboratory animals and sheep.

It proved possible to provoke good haemagglutination titres in rabbit serum; this test could be a valuable diagnostic agent in acute and recovery phase serums.

Attention was also given to internal abscesses in foals on the SADF stud farm. Approximately 50% of all foals are affected annually. It was found that the condition was caused by *Corynebacterium equi* and *Streptococcus zoo-epidemicus*. A programme of foaling box hygiene was suggested. Experiments on *geeldikkop* were continued. The toxic fraction present in *Tribulus terrestris* was extracted completely, using 50% ethanol at 4°C, followed by freeze-drying.

Investigations into the effect of the stage of growth and other factors on the toxicity of the plant were continued.

For the first time in history "dronksiekte" was induced in a calf after voluntary ingestion of *Melica decumbens* (dronkgras).

Research on game and diseases of game

Research on game and diseases of game in the Kruger National Park was mainly confined to foot-and-mouth disease. During the year under review certain samples, mainly blood samples, were taken from elephant and buffalo when these animals were culled. These samples are stored and will be forwarded to the Foot-and-Mouth Laboratory at Onderstepoort as soon as this laboratory is commissioned.

VACCINES AND ANIMAL REMEDIES

The following vaccines were produced by State veterinarians, veterinary laboratories and/or Regional veterinary laboratories

Heartwater	6 213 millilitres
Autogenous wart	11 755 millilitres
Contagious pustular dermatitis (orf)	7 570 doses
<i>Leptospirosis</i> experimental vaccine	9 100 millilitres
<i>E. coli</i> experimental vaccine	1 000 millilitres
<i>Pasteurella</i> experimental vaccine	7 500 millilitres
<i>Staphylococcus aureus</i> experimental vaccine	8 000 millilitres
<i>Clostridium perfringens</i> experimental vaccine	500 millilitres

The following laboratory products were produced by the laboratories mentioned below:

<i>Regional veterinary laboratory, Middelburg (CP)</i>	
Solid and fluid media	19 422 millilitres
Reagents	81 600 millilitres
<i>Pasteurella haemolytica</i> antigen	460 millilitres
<i>Actinobacillus seminis</i> antigen	600 millilitres
<i>Bacillus</i> antigen	70 millilitres

<i>Regional veterinary laboratory, Grahamstown</i>	
Solid and fluid media	277 080 millilitres
Complement	165 millilitres
Reagents	302 753 millilitres
Stains	4 795 millilitres

<i>Veterinary Laboratory, Queenstown</i>	
Solid and fluid media	48 490 millilitres
Reagents and stains	28 400 millilitres
Petri dishes poured	1 330 millilitres

No vaccines were destroyed on account of improper storage or because the expiry date had been reached.

CONTROL OF ANIMAL DISEASES

NOTIFIABLE DISEASES

Foot-and-mouth disease

The infection in the Malamulele district of Gazankulu mentioned in the previous report reached a clinical end point on 22 June 1979, but unfortunately the dipping tank area of Muribane was found on 23 June 1979 to be infected and a total of 5 dipping tank areas eventually became infected. A total of 58 521 cattle were vaccinated with SAT II vaccine and cordons were removed on 15 August 1979.

In the Giyani district of Gazankulu the infection spread to a further five dipping tank areas, which brought the total of infected dipping tank areas to 12. A total of 45 709 cattle were vaccinated with SAT II vaccine and all cordons were removed on 23 November 1979.

In the Vumani I district of Venda the infection spread to a further two dipping tank areas, namely Schiel (14 August 1979) and Vygeboom (16 July 1979). A total of 24 033 cattle were vaccinated with SAT vaccine and cordons were removed on 23 November 1979.

On 12 July 1979 the farm Casketts in the White area of Pilgrim's Rest was found to be infected. A further four adjoining farms also became infected. This infection was also caused by the SAT II virus and probably originated from the infected farm of Welverdiend in the Mahla district of Gazankulu. In all 5010 head of cattle were vaccinated with SAT II vaccine. No cordons were placed around these farms, since they were all fenced with game-proof fencing. Guards were, however, posted at all the gates giving access to the farms. The last infected animal was seen on 16 July 1979.

On 13 December 1979 a new outbreak occurred in the Thomo dipping tank area of the Giyani district of Gazankulu. By the end of the year under review, i.e. 31 March 1980, no fewer than 28 dipping tank areas were infected. This infection was caused by the SAT III virus. On 22 November 1979 the dipping tank area of Makuya in the Sibasa district of Venda was reported to be infected. This infection spread to adjoining dipping tank areas and a total of twelve (12) dipping tank areas were eventually infected. The SAT I virus was responsible for this infection.

On 15 January 1980 the Mtimkulu B dipping tank area in the Bolobedu district of Lebowa was found to be infected. The infection spread to adjoining dipping tank areas and a total of four dipping tank areas were eventually affected. This infection was also caused by SAT III virus.

All the above outbreaks occurred in the foot-and-mouth control areas adjoining the Kruger National Park.

Since all the outbreaks except one occurred in independent Black states or national states, officers of the Division of Veterinary Services had to be seconded to these states to assist in combating the disease.

The usual control measures were immediately applied, such as a total embargo on the movement of cloven-hoofed animals or their products, the isolation of the infected area through cordons and the vaccination of infected animals on infected farms and also susceptible animals on adjoining farms.

Owing to the presence of foot-and-mouth infection in Zimbabwe, more stringent control measures were applied in the Messina district. The redline area of Messina which borders on the Limpopo River was placed on a seven-day inspection interval.

To prevent the spread of infection from Gazankulu and Lebowa a cordon was also imposed on the southern bank of the Great Letaba river in the Letaba district. In the Louis Trichardt, Messina, Letaba, Pilgrim's Rest and Barberton districts a total of 128 683 cattle and 2 879 sheep and goats were vaccinated against foot-and-mouth disease.

When buffalo were culled in the Kruger National Park, 102 carcasses were condemned on account of foot-and-mouth lesions. This diagnosis has still to be confirmed.

At the time of the foot-and-mouth campaigns in Venda, Lebowa and Gazankulu, 19 head of cattle and 17 goats were destroyed and burnt to prevent the spread of the disease. Although the value of these animals amounted to R2 920 no compensation was paid to the owners.

In the Barberton district 72 head of cattle were introduced illegally from Mozambique. These animals were returned to Mozambique and handed over to the authorities. Fifty-one goats were also introduced illegally from Mozambique. These goats, valued at R768, were destroyed and burnt. Five cattle introduced illegally from Mozambique and valued at R650 were also destroyed and burnt.

Thirty-four cattle were illegally introduced into the Messina district from Zimbabwe. Of these animals four were destroyed and burnt and the remaining 30 sold for R2 100. The owner of the animals was prosecuted.

Seven goats were illegally introduced into the Zoutpansberg district from Botswana. These goats were also destroyed and burnt.

In none of the above-mentioned cases was any compensation paid to the owners.

Rabies

Of the 788 specimens submitted to the Veterinary Research Institute by officers of the Division of Veterinary Services, 251 (31,9 %) were positive for rabies. In the previous year 728 specimens were submitted, 29,5 % of which were positive. The present annual report covers a period of only 9 months.

The following number of cases of the disease occurred among the various carriers:

Yellow mongooses	63
Cattle	75
Dogs	70
Species of wild cat	4
Domestic cats	9
Jackals	19
Skunks	1
Sheep	4
Humans	2
Goats	1
Kudu	1
Badgers	1
Duikers	1
	251

In Natal outbreaks have spread to the southern parts of the coastal region, infected dogs from KwaZulu having in all probability been the source of infection. Cases have been diagnosed as far south as Durban.

There was also an increase in the incidence of rabies in the Highveld Region, especially in the Kroonstad district. The animals primarily affected were yellow mongooses and cattle. In order to exterminate the mongooses a total of 87 colonies and 401 single holes in an area of 5 649 hectare were treated with 4 144 Phostoxin tablets.

The Transvaal Region reported 56 positive cases, compared to 45 the previous year. The infection is moving steadily southwards in the Rustenburg district and nine cases have already been diagnosed within 20 kilometres of the town.

In the Northern and Eastern Transvaal and Transvaal Regions 10 487 cattle were immunised against rabies.

Forty-eight specimens were received from KwaZulu and 35 of these specimens were positive for rabies. Six of these 35 positive specimens were from humans.

In all 158 493 dogs and 16 369 cats were immunised by officers of the Division of Veterinary Services. Immunisation was also carried out in the national states where 74 015 dogs and 2 811 cats were inoculated.

Anthrax

Three outbreaks occurred during the year under review. As in the previous year, all these outbreaks occurred in the Highveld and Free State Regions. The mortality figure among cattle as a result of the outbreaks was only six.

As a general preventive measure, and during outbreaks, officers of the Division of Veterinary Services inoculated 1 766 599 cattle and farmers inoculated 174 788.

In the national states 1 205 789 cattle were immunised as a preventive measure by officers of the various veterinary services.

East Coast fever and related diseases

East coast fever (*Theileria parva*)

No cases occurred. A total of 2 051 cattle spleen smears from Vryheid and Hluhluwe State veterinary areas were examined. In KwaZulu 160 098 spleen smears were examined and Koch's bodies were only found in one smear.

Corridor disease (*T. lawrencei*)

No cases were reported.

Benign bovine theileriosis (*T. mutans*)

A serological survey undertaken among cattle in the Messina district confirmed the presence of *T. mutans*.

Other forms of theileriosis

Theileria taurotragi was confirmed in an eland that died on the Killarney Game Ranch in Natal.

Tuberculosis

(Figures for the previous year are given in brackets).

The eradication of tuberculosis in cattle herds

is still progressing well. During the year under review 4 374 (4 336) certificates were issued to tuberculosis-free herds, and 6 785 (6 033) herds participated in the bovine tuberculosis eradication scheme. A total of 2 527 (3 064) positive reactors were slaughtered during the year under review, which ended on 31 March 1980. The owners of these cattle received R515 958 (R581 650) by way of compensation.

Carcases not condemned as being unfit for human consumption were sold for R309 216 (R332 144) and the moneys paid into Miscellaneous Revenue.

In terms of this scheme R540 987 (R510 776) was paid out to contracted private veterinarians for tests and services rendered on behalf of the State. A total of 415 (403) veterinarians are now participating in the scheme. The total outlay of the scheme for the past financial year was R1 700 059 (R1 133 510).

Since the initiation of the scheme 926 (854) previously infected herds have qualified for tuberculosis-free certificates. An additional six herds have been treated with INH, bringing the total to 79 since the start of the scheme.

According to tests carried out, the incidence of bovine tuberculosis is 2,9 %.

A summary of the tests carried out during the year is given in Table 1.

The incidence of tuberculosis in swine in the Transvaal Region is giving cause for concern. A total of 425 pigs belonging to a pig farmer were condemned for generalised tuberculosis, which meant a loss of approximately R28 000.

In the Highveld Region good progress was made with the tuberculosis eradication scheme. Over 70 % of the cattle in the Districts of Oberholzer, Potchefstroom, Ventersdorp, Lichtenburg, Wolmaransstad and Klerksdorp have already been tested.

TABLE 1 - Tuberculin tests carried out during 1979/80

Test	No. of herd tests	No. of tuberculin tests	Reactions	
			Positive	Suspected
Accreditation	4 874	726 969	-	720
Diagnostic herd	1 139	135 746	-	69
Infected	534	118 146	1 715	480
INH	27	8 197	168	45
Export	50	3 647	-	1
Import	1	48	-	-
Diagnostic	302	21 154	-	29
Total	6 927	1 013 907	1 883	1 344

Bovine brucellosis (*Brucella abortus*)

The number of heifers between the ages of three and 11 months inoculated with Strain 19 vaccine in White areas either by or under the supervision of officers of the Division of Veterinary Services amounted to 222 390 and owners themselves inoculated a further 30 072. The number

of cows vaccinated under official supervision amount to 4 767.

In the national states 53 099 heifers were inoculated.

The voluntary accreditation scheme has shown steady growth and 782 herds comprising 60 614 cattle have been tested during the nine months covered by this report. Of this number, 191 herds (24,4 %) and 1 698 cattle (2,8 %) were found to be infected. The number of brucellosis-free certificates issued was 176.

The diagnostic scheme did not, however, progress as well as had been expected, mainly because of the absence of officers who had to assist with the foot-and-mouth and sheep scab campaigns.

Despite these setbacks, 85 437 cattle from 1 612 herds were tested. Of this number, 567 herds (35,2 %) and 4 027 cattle (4,7 %) were positive reactors.

The veterinary laboratory at Potchefstroom again tested all milk samples (received for mastitis investigation), for brucellosis by means of the milk ring test. Of the 1 078 milk samples tested, 157 (14,5 %) were positive for brucellosis.

Brucella abortus germs were isolated from 47 samples of abortion material.

A summary of tests done is given in Table 2.

TABLE 2 - Tests for bovine brucellosis

Test	No. of tests	
Rose-Bengal	149 385	
Complement fixation	42 385	
Tube agglutination	29 871	
Milk tests		
Type of test	No. of tests	No. positive
Milk ring test	2 041	282
Bacteriological/ Biological	37	23

Trypanosomiasis

Nagana

In the Natal Region a single case of nagana *Trypanosoma congolense* in a bovine was diagnosed microscopically on a farm bordering on Lake St Lucia.

The animal was treated with Forray 65 but the parasites reappeared in the blood after a period of two months. The animal was subsequently treated with Berenil and made an uneventful recovery.

Blood smears of 245 buffalo and 27 elephants from the Kruger National Park were all negative for trypanosomes.

Dourine

Of the 2 339 samples tested by the Veterinary Research Institute and regional veterinary

laboratories, only 48 (2,05 %) were positive.

Stallions that show a positive reaction are either castrated or slaughtered and mares sterilised or slaughtered. No compensation is paid to the owners since all tests are carried out at their request.

Lumpy skin disease

A few cases were encountered in all the regions except the Eastern Cape and Karoo Region. In the Natal Region 15 outbreaks were reported and in the Free State Region only 2. It must be assumed from the reports that the outbreaks were caused by the Allerton strain of the virus.

Officers of the Division of Veterinary Services assisted with the inoculation of 4 068 cattle. In KwaZulu the disease occurred throughout the Nongoma and Hlabisa districts. A total of 2 104 cattle were vaccinated.

Sheep scab

The number of outbreaks decreased from 351 in 1978/79 to 280 during the year under review. It must, however, be borne in mind that the year under review covers a period of 9 months only.

The compulsory dipping campaign was successfully carried out, excellent co-operation having been obtained from farmers.

By 31 January 1980, 30 878 518 sheep had been dipped and 553 474 had still to be dipped. Legal proceedings were instituted against 37 farmers whose sheep had not been dipped on or before 31 January 1980.

2 296 dipping supervisors were appointed, 1 941 of whom assisted with the dipping campaign. Preliminary expenditure was calculated at R839 997,60, to which must be added outstanding claims, and the cost of printing, which will bring the total amount to an estimated R875 000.

A report on progress made with the dipping campaign was supplied to all the provincial branches of the National Woolgrowers Association as well as to the sheep scab liaison committee.

The magisterial districts in which infection occurred, and the number of outbreaks in each district, were as follows:

Nqutu 15, Philippolis 13, Idutywa 10, Glen Grey 9, St Marks 8, Nkandla 8, Boshof 8, Petrusburg 8, Umtata 7, Xalanga 7, Carnarvon 7, Calvinia 6, Queenstown 6, Pretoria 6, Hewu 6, Qumbu 5, Jacobsdal 5, Uitenhage 5, Engcobo 5, Laingsburg 5, Hennenman 5, Middelburg 5, Theunissen 5, Ventersburg 4, Tsomo 3, Bloemfontein 3, Herbert 3, Koffiefontein 3, Wepener 3, Maclear 3, Bothaville 3, Kroonstad 3, Virginia 3, Wesselsbron 3, Bronkhorstspuit 3, Delmas 3, Mt Fletcher 2, Nqamakwe 2, Herschel 2, Belfast 2, Madadeni 2, Fauresmith 2, Jagersfontein 2, Reddersburg 2, Dundee 2, Aliwal North 2, Elliot 2, Graaff-Reinet 2, Namaqualand 2, Bultfontein 2, Coligny 2, Fouriesburg 2, Odendaalsrus 2,

Ventersdorp 2, Thaba Nchu 2, Heidelberg 2, Lydenburg 1, Barkly West 1, Excelsior 1, Gordonia 1, Rouxville 1, Warrenton 1, Babanango 1, Pietermaritzburg 1, Burgersdorp 1, Steytlerville 1, Venterstad 1, Victoria West 1, Ceres 1, Clanwilliam 1, Vredendal 1, Delareyville 1, Heilbron 1, Klerksdorp 1, Lichtenburg 1, Ottosdal 1, Parys 1, Potchefstroom 1, Sasolburg 1, Schweizer-Reneke 1, Viljoenskroon 1, Wolmaransstad 1, Johannesburg 1, Boksburg 1, Alberton 1, Balfour 1, Standerton 1, Willowvale 1, Modimo 1, Tsolo 1, Flagstaff 1, Mqanduli 1.

Seventy-one districts in the White areas were infected and 23 in the national states.

In all, 321 828 head of small stock on infected or contact farms in the White area were dipped.

Sheep on infected premises or farms were dipped under official supervision at least twice, with an interval of 8-10 days, using an approved dipping compound.

Owing to outbreaks of foot-and-mouth disease, namely Venda en Gazankulu, national states did not dip their sheep.

In KwaZulu dipping was carried out in part of the territory only.

Dipping was undertaken by the other national states, as agreed.

Mange

Mange was widespread, especially among cattle and pigs.

One outbreak of goat mange, involving 209 goats, occurred in the Natal Region. Goat mange also occurred in KwaZulu, mainly in the Ingwavuma district. In the Kruger National Park mange was established in lions, giraffe and gnu (blue wildebeest).

African swine fever

There was only one outbreak of African swine fever. It occurred on a farm in the Letaba district where warthog offal was fed to pigs. Of the 26 pigs involved in the outbreak, 23 died and the remaining 3 were destroyed and cooked.

One White man in the Soutpansberg district and two in the Marico district were prosecuted for illegally transporting warthog carcasses. Fines of R300, R30 and R20 were imposed.

There were 489 approved piggeries with 42 699 pigs in the White areas.

Swine erysipelas

Outbreaks of the disease, of which 14 were reported, occurred in all the regions. The administration of antibiotics, together with preventive inoculations, effectively controlled the disease.

Epizootic lymphangitis

No cases were reported.

Johne's disease

Two outbreaks, involving two cattle, were confirmed in the Highveld Region. One of the animals was an imported animal and the other one the progeny of imported parents. Both animals were destroyed and R1 380 was paid to the owners in compensation.

Infectious laryngotracheitis

Three outbreaks were diagnosed in the Eastern Cape and Karoo Region and two in the Transvaal Region. In the latter case approximately 200 fowls out of a total of 200 000 died of the disease. All the birds were immediately immunised and no further deaths were reported.

Rinderpest

This disease does not occur in the Republic.

Newcastle disease

Isolated outbreaks occurred in the Natal (3) and Highveld (1) Regions.

A suitable vaccination programme for Newcastle disease was investigated by the regional veterinary laboratory at Stellenbosch. Sufficient information has been accumulated for the following programme to be suggested: Two administrations of La Sota vaccine, namely at 3 to 4 weeks of age and then again at 10 to 12 weeks of age, followed by an inoculation of inactivated oil-emulsion vaccine at 18 to 20 weeks of age.

Bacillary white diarrhoea (BWD) and fowl typhoid

Only four outbreaks were recorded. Of these outbreaks, two occurred in the Highveld Region and one each in the Eastern Cape and Karoo and Natal Regions.

Fowl cholera

No cases were reported.

Psittacosis

An outbreak occurred in a pet shop in Pretoria. The premises were quarantined and all birds treated for a period of one month.

Scrapie

No cases were reported.

Equine infectious anaemia

No cases were reported.

Glanders

No cases have been reported in the Republic since 1945.

Contagious bovine pleuropneumonia

No cases have been reported in the Republic since 1924.

NON-NOTIFIABLE DISEASES

Bacterial diseases

Mastitis

Several Regional veterinary laboratories and other veterinary laboratories have again demonstrated that *Staphylococcus aureus* is the most common organism isolated from the milk of cows with mastitis.

In the Natal Region another 21 herds joined the Mastitis Control Scheme, bringing the total of herds participating in this scheme to 109. Trials conducted with *Staphylococcus aureus* toxoid gave very promising results in that there were fewer cases of *Staphylococcus aureus* mastitis in vaccinated herds. Furthermore, cases of gangrenous mastitis did not occur and clinical cases responded more favourably to treatment. The total number of cows in the 109 herds participating in the scheme was 11 560 and the number of somatic cell counts 15 786.

In the Highveld Region a total of 14 442 milk samples from 139 herds were examined. Tests showed that *Pseudomonas aeruginosa* also played an important role and that most of the mastitis remedies had little effect on this organism. Subclinical mastitis was in most cases attributable to infection with either *Pseudomonas aeruginosa* or *Escherichia coli* or both.

Cases of blue udder occurred among sheep in the Western Cape Region and the responsible bacteria were identified as *Staphylococcus aureus* and *Escherichia coli*. This condition was also encountered in sheep in the Highveld Region.

Enterotoxaemia (pulpy kidney)

Sporadic cases occurred in all the Regions except for the Eastern Cape and Karoo Region, where outbreaks were widespread. This was mainly due to the fact that farmers did not inoculate their sheep or that the vaccine was not administered or handled in the prescribed way.

In the Highveld Region officers of the Division of Veterinary Services assisted with the inoculation of 15 122 sheep.

In the Ciskei 215 890 sheep were inoculated against pulpy kidney.

Black quarter

Except for the Western Cape, where sporadic cases occurred in the District of Knysna, the disease was rife throughout all the regions.

In the Natal Region 204 deaths were recorded, in the Highveld Region 175, in the Transvaal Region 234 and in the Northern and Eastern Transvaal Region 70. Cases of puerperal black quarter in sheep and goats were diagnosed in the Highveld and Northern and Eastern Transvaal Regions.

In the Highveld Region officers of the Division of Veterinary Services assisted farmers in inoculating 93 769 animals.

In Gazankulu 207 deaths among cattle were reported. A total of 234 160 cattle were vaccinated in the Black states. Quite a number of cattle died from anaphylactic shock after inoculation.

Botulism

Sporadic cases occurred in all the Regions.

In the Western Cape Region 2 148 sheep belonging to 19 owners died of this disease. In the Eastern Cape and Karoo Region 5 out of a total of 23 American saddle-horses died.

As a result of the drought in the Free State Region dams became dry and the decomposing fish caused botulism in waterfowl and livestock.

Eighty-nine deaths were recorded in the Highveld Region; 22 of this number were caused by fowl manure which had been used as a feed.

In the Transvaal Region 8 cattle and 5 geese died of the disease and in the Northern and Eastern Transvaal 4 cattle died.

Officers of the Division of Veterinary Services assisted farmers in inoculating 16 620 cattle in the Highveld Region.

Corynebacteriosis

This disease was widespread throughout the Republic.

At the Cato Ridge abattoir in the Natal Region 1 921 sheep and goat carcasses, 3 439 sheep and goat lungs and 4 590 sheep and goat livers were condemned on account of *Corynebacterium* abscessation.

In the Eastern Cape and Karoo Region mass infestation of the head and ears of goats, mainly by the tick *Rhipicephalus appendiculatus*, caused meningeal and hypophyseal abscessation.

In the Transvaal Region the State Veterinarian at Piet Retief reported that on one farm approximately 60 % of the 150 dairy cows had one or more visible abscesses. Numerous cases of arthritis and sheath abscesses in bulls were treated by the State Veterinarian at Rustenburg.

In the Northern and Eastern Transvaal Region the organism was isolated from aborted foetuses.

Spinal and lung abscesses occurred on a farm in the Lydenburg State veterinarian's area.

Spinal abscesses in lambs were again encountered in lambs in the Free State Region.

Pasteurellosis

This disease was again widespread in both cattle and small stock throughout the Republic.

In the Natal Region the disease was mainly confined to calves and sheep. Sixty calves and 32 sheep died of pasteurellosis.

Mortality in the Western Cape Region occurred mainly among calves and lambs in intensive systems. In the Calvinia State veterinary area 225 deaths were reported among sheep.

Angora goat farming has been started in the Highveld Region and six flocks have already been established. In two of these flocks 29 goats have already died of pasteurellosis. Sixty-eight lambs have also succumbed to this disease.

Four cows and 64 sheep died in the Transvaal Region. In the Northern and Eastern Transvaal the disease was mainly confined to sheep, and the mortality figure was 69.

Tetanus

A few cases occurred throughout the Republic. In practically every case reported the elastrator rubber ring, which is used for castrations and docking the tails of lambs, was involved.

Twelve deaths were reported among lambs in the Natal Region.

In the District of Calvinia in the Western Cape Region 173 sheep died of tetanus.

Two horses from the SADF Equestrian Centre in the Highveld Region also died of this disease.

Tetanus was the cause of death of seven kids, three calves and two horses in the Northern and Eastern Transvaal Region.

Colibacillosis

Sporadic cases were encountered in all the regions.

Mortality occurred in intensive calf and pig rearing units in the Western Cape Region. Poor housing and management were responsible for the spread of the disease. In pigs the disease usually makes its appearance soon after weaning, especially if the piglets are weaned at an early age. Regular vaccination with *E. coli* vaccine can control the disease.

The calf mortality figure was 31 in the Transvaal Region and 10 in the Northern and Eastern Transvaal Region.

Leptospirosis

Reproduction problems were encountered in sows on 8 farms in the Western Cape Region where the disease is endemic. *Leptospira pomona* experimental vaccine proved effective for controlling the disease.

Large-scale abortions and perinatal mortality occurred in a piggery in the Eastern Cape and Karoo Region. The causal organism was identified as *L. pomona*.

Abortions among stud South Devon cows in the Highveld Region were caused by *Leptospira* organisms. Sixty cows out of a herd of 300 aborted in late pregnancy. An experimental vaccine was used and the animals were also treated with antibiotics.

Pseudomonas infection

This organism was mainly responsible for cases of mastitis but was also isolated from sheath washings of rams and from wool which showed a green discoloration.

Actinobacillosis and actinomycosis

A few cases were reported among cattle from all the regions except the Natal and Transvaal Regions.

Actinobacillus equili

Was isolated from an aborted foal in the Northern and Eastern Transvaal Region.

Foot rot and foot abscess

Foot abscesses were widespread, particularly among sheep and goats, in the Eastern Cape and Karoo Region. During the winter similar problems were encountered with foot-rot in cattle in the Western Cape Region, where up to 8% of the cattle kept in intensive units were affected. The occurrence of foot abscesses among sheep kept on artificial pastures was as high as 15%.

The disease was severe in the Piet Retief district of the Transvaal Region, where approximately 600 sheep out of a flock of 2000 were affected with foot abscesses. In the same district there was a herd of cattle in which approximately 10% were affected with foot rot.

In the Northern and Eastern Transvaal Region foot rot affected mainly goat herds.

Strangles

A single outbreak occurred in the Highveld Region, involving 25% of the horses at a riding school.

Lamb dysentery

No cases were reported.

Listeriosis

A single case of listeriosis occurred in the Natal Region.

Red gut

This disease was widespread among sheep in the Swellendam State veterinary area of the Western Cape Region, especially during the winter months on farms with lucerne or clover pastures.

Navel ill

Cases of navel ill were general in lambs in the Free State Region. *Fusiformis necrophorus* was mainly responsible for this infection.

Protozoal diseases

Babesiosis

As in previous years this disease was prevalent in all the Regions.

In the Natal Region it was again the most important disease, with 510 reported outbreaks involving 1 339 cattle.

A survey undertaken in the Western Cape Region showed that antibodies against *Babesia bigemina* were present in the blood of cattle from the Districts of Swellendam, Caledon, Hermanus and Bredasdorp, and that antibodies against *Babesia bovis* were also present, although not on all the farms included in this survey.

Twenty-one outbreaks involving 78 cattle were recorded in the Highveld Region.

In the Transvaal Region, where 137 outbreaks involving 759 cattle were reported, this disease was also the leading cause of mortality in cattle.

A serological survey undertaken in the Messina district of the Northern and Eastern Transvaal Region showed the presence of antibodies against *B. bigemina* in practically all of the cattle that were tested, but a total absence of antibodies against *B. bovis*. Thirteen cases of *B. equi* were diagnosed in horses imported from Zimbabwe. In the Lydenburg State veterinary area *Babesia bovis* was found in 90% of all the smears examined for redwater and found to be positive. There were 18 outbreaks of babesiosis in the Northern and Eastern Transvaal Region, with 70 deaths.

There was a further reduction in the incidence of babesiosis in Kwazulu, owing to better dipping tank management.

In the Ciskei 508 cattle were treated for babesiosis.

Anaplasmosis (*gall-sickness*)

Anaplasmosis, which is a serious stock disease in the Republic, occurred in all the regions.

In the Natal Region 247 outbreaks were recorded, involving 458 cattle.

On a farm in the Stellenbosch State veterinary area 11 out of 25 jersey cows died suddenly after cattle had been introduced from Swellendam.

Several outbreaks occurred in the Transvaal Region, where 74 cattle were involved.

In the Northern and Eastern Transvaal Region 41 cattle died of the disease.

In KwaZulu the disease does not appear to be troublesome but in the Ciskei 224 cattle were treated and 32 cattle died in KaNgwane.

Besnoitiosis (*elephant skin disease*)

A single case was diagnosed in each of the Free State and Highveld Regions.

There was a decline in the incidence of the disease in the Transvaal Region, where only three cases were recorded.

In the Louis Trichardt State veterinary area in the Northern and Eastern Transvaal Region 5 bulls were condemned on account of infertility and in the Lydenburg State veterinary area 6 cattle were found to be infected.

Officers of the Division of Veterinary Services assisted farmers in inoculating 937 head of cattle in the Highveld Region.

Coccidiosis

Sporadic cases of coccidiosis occurred among calves and lambs throughout the country, especially where the animals were kept on artificial pastures.

The regular dosing of lambs with a coccidiostat is a common practice in the Western Cape Region.

Of the 1911 post mortems performed on poultry in the Highveld Region, 25,4 % were positive for coccidiosis.

In the Northern and Eastern Transvaal Region 19 calves, 50 goats and 90 chicks were found to be infected with coccidiosis.

Virus diseases

Bluetongue

Only a few outbreaks were recorded in the Republic. Farmers had difficulty in carrying out the vaccination programme with the new vaccine, which has to be administered in three phases, and quite a number stopped vaccinating their sheep against bluetongue.

Only 250 sheep were vaccinated in the Ciskei.

African horsesickness

Isolated cases were diagnosed in the Republic.

In the Western Cape Region four cases were reported, in the Natal Region one, in the Free State Region one, in the Highveld Region six and in the Northern and Eastern Transvaal Region eight.

Heartwater

A considerable number of outbreaks were recorded in the heartwater endemic areas.

In Natal, where sporadic outbreaks were encountered, 817 cattle and 79 sheep and goats were affected.

There was undoubtedly an increase in heartwater outbreaks in the Transvaal Region, although only 128 cases were recorded.

In the District of Mafeking the disease spread southwards to the Piet Plessis area.

In the Western Cape Region the disease was still confined to the Little Brak River and Hartenbos Valley areas.

Three cattle died in the Fochville district of the Highveld Region after cattle from the Northern Transvaal bushveld had been introduced to the farm. Officers of the Division of Veterinary Services assisted farmers in vaccinating 2 033 cattle.

An experiment was started at the Mara Research Station in the Northern and Eastern Transvaal Region to determine why calves inoculated with heartwater blood before the age of three weeks still succumb to heartwater as soon as they are exposed to tick infestation. An attempt will also be made to compare the level of immunity of calves which acquired a natural infection to that of calves which were artificially infected with heartwater blood. Ten sheep and 81 cattle died of the disease in the Northern and Eastern Transvaal Region. Angora goats that were introduced from the Eastern Cape to the Soutpansberg district still showed a 10 % mortality, notwithstanding intensive treatment.

In the Eastern Cape and Karoo Region cases of heartwater were diagnosed in the State veterinary areas of Queenstown, Grahamstown and Port Elizabeth.

Ephemeral fever (*three-day stiffness*)

Isolated cases of the disease occurred throughout all the Regions. Morbidity as well as mortality was low. In the Piet Retief State veterinary area of the Transvaal Region 375 cases occurred on 25 farms. In the Pretoria State veterinary area 17 cases were diagnosed on 5 farms and mortality reached 41 %.

Twelve cattle died from the disease in the Ellisras State veterinary area and in the Louis Trichardt State veterinary area four stud bulls were severely affected.

In the Natal Region 32 outbreaks were recorded, involving 155 cattle.

Officers of the Highveld Region assisted with the inoculation of 3 240 head of cattle.

Rift Valley fever and Wesselsbron disease

A single outbreak involving four cattle occurred in the District of Mtunzini in the Natal Region.

Bovine malignant catarrh

Nine outbreaks of the disease, which resulted in 223 deaths among cattle, occurred in the Transvaal (three outbreaks), Natal (one outbreak), Highveld (two outbreaks) and Northern and Eastern Transvaal (three outbreaks) Regions.

In all these outbreaks there had been previous contact with blue wildebeest. In one outbreak in the Highveld Region 42 Brahman cattle, valued at R66 000, died of the disease.

Pulmonary adenomatosis (*jaagsiekte*)

Outbreaks were recorded in all the Regions except for the Transvaal and Northern and Eastern Transvaal Regions.

Infectious ophthalmia

This disease occurred throughout the Republic.

In outbreaks among sheep in the Malmesbury district of the Western Cape Region practically 100 % of the flocks were affected.

Dairy herds in the Kuils River area showed a 50 % infection. At the Elsenburg College of Agriculture 80 % of the sheep were infected.

At the SADF Equestrian Centre in the Highveld Region approximately 16 % of the horses were affected and 3 % became totally blind.

The State Veterinarian, Standerton, reported that in some cattle herds up to 50 % of the animals were affected.

In some cattle herds in the Northern and Eastern Transvaal Region up to 80 % of the herd became infected.

Contagious pustular dermatitis (*vuilbek, orf*)

Sporadic outbreaks occurred in all the Regions.

Two outbreaks involving 69 kids were reported from the Natal Region. In the Highveld Region 50 % of the kids on one farm were infected and the adult goats were also affected to a lesser degree.

Two outbreaks in lambs were encountered in the Transvaal Region. In the Louis Trichardt State veterinary area 23 kids died of starvation.

Autogenous vaccines are prepared and used, but the disease is generally so far advanced before help is sought that the vaccine makes no real difference to the course of the disease.

Mucosal disease

Three cases were diagnosed in cattle in the Eastern Cape and Karoo Region.

In the East London State veterinary area antibodies against the disease were again found in the serum of ewes that had aborted.

A suspected outbreak occurred in the Natal Region, where 6 young heifers died.

Infectious bovine rhinotracheitis

In the Transvaal Region the disease caused problems among the bulls at the Animal and Dairy Science Research Institute at Irene. Even when vaccine is used the bulls still develop a mild form of the disease and treatment has to be instituted.

One outbreak involving seven cattle occurred in the Lions River district of the Natal Region.

Two outbreaks were confirmed in feedlots in the Kuruman State veterinary area.

Akabane virus

No outbreaks of Akabane virus infection were reported.

Feline infectious enteritis

A few cases were diagnosed in the Western Cape and Eastern Cape and Karoo Regions.

Fungal diseases

Ringworm

Sporadic cases were diagnosed in all the Regions.

In the Natal Region two outbreaks involving 20 horses and an unknown number of cattle were reported.

The State Veterinarian at Kimberley encountered numerous cases of ringworm in Karakul flocks. The fungus responsible was identified as *Trichophyton verrucosum*.

Lumpy wool

A few cases were again encountered in the Mt Currie and Underberg districts of Natal.

Serious outbreaks were encountered in two flocks in the Malmesbury district of the Western Cape Region. In one flock 100 % of the 300 young sheep were affected and seven died. In the other flock, which numbered about 600 Dorper and Merino sheep, only the Merinos were affected.

Sporadic cases occurred in the other Regions, with the exception of the Northern and Eastern Transvaal Region.

Streptothricosis (*Senkobo*)

The only confirmed cases occurred in the Districts of Hlabisa and Mkuze in the Natal Region.

Infertility and venereal diseases

In all the Regions malnutrition, poor management and venereal diseases were implicated, to a greater or lesser extent, in infertility.

The dry conditions which prevailed over certain parts of the Republic undoubtedly had an adverse effect on lamb and calf crops in those parts. In the Namaqualand district 1 895 goat ewes aborted owing to the drought.

Poor management was responsible for the low calving percentage in 3 herds in the Malmesbury district.

In the Highveld Region 594 bulls from 42 herds were examined for fertility. Thirty-three bulls were found to be infertile. Thirty-five rams from eight herds were also examined and 12 rams were found to be infertile.

The veterinary laboratory at Kroonstad examined 311 sheath washings from bulls and isolated pathogenic organisms from 30 % of the specimens. *Actinobacillus seminis* was the more prevalent organism isolated. To determine the pathogenicity of *A. seminis* in cattle, 10 heifers which had been synchronised were inseminated with infected semen. Six heifers conceived. No *A. seminis* organisms could be demonstrated in the uterine mucus of the remaining four heifers after a period of three months. It must therefore be concluded that *A. seminis* does not play a major role in bovine infertility.

Prolapse of the sheath in Brahman and Santa Gertrudis bulls was one of the major problems encountered in the Transvaal Region.

The State Veterinarian, Louis Trichardt, examined 2 778 cows from 18 herds for pregnancy; the average percentage of pregnancies was 72,3 %. Of the 164 bulls he examined 11 were condemned, mainly because of abnormalities of the testes.

The herds examined for pregnancy by the State Veterinarian, Lydenburg, were mainly problem herds; of the 834 cows examined 58 % were pregnant. Management problems were chiefly responsible for the low pregnancy percentage.

Vibriosis

The disease was again diagnosed in all the Regions. An examination of the sheath washings of 931 bulls showed that 26 (2,7 %) were positive for vibriosis. The vaccine is now widely used.

Trichomoniasis

Trichomoniasis infection of bulls was diagnosed in all the Regions with the exception of the Free State, Transvaal and Western Cape

Regions.

Of the 1 026 sheath washings examined, 39 (3,8 %) were positive for trichomoniasis.

Chlamydiosis

Very few abortions caused by this disease have been encountered.

The chronic form of the disease was prevalent in the Western Cape Region, where it caused retarded growth and arthritis in lambs. In some flocks up to 40 % of the lambs were affected.

In the Natal Region *Chlamydia* organisms were isolated from two bovine foetuses and seven lambs. The organisms were also isolated from four foetal samples from the Northern and Eastern Transvaal Region.

Actinobacillus seminis

The Regional veterinary laboratory at Stellenbosch examined 1 219 semen samples from rams, and of these 16 (1,3 %) were positive for *Actinobacillus seminis*.

Of the 1 687 semen samples examined by the Regional veterinary laboratory at Middelburg (CP), 39 (2,3 %) were positive. The serum of 1 751 rams was tested and 8,3 % of specimens were found to be positive.

In the Highveld Region the veterinary laboratory at Potchefstroom examined 225 vaginal mucus samples from ewes and found 57 (25,3 %) of these to be positive. Of the 69 semen samples from rams examined 11 (15,9 %) were positive.

The incidence of infection in rams in the Kuruman State Veterinary area in the Free State Region varied from 6 % to 10 %. In one instance only 30 of the 150 rams examined were not infected.

Brucella ovis

Of the 1 219 samples examined by the Regional veterinary laboratory at Stellenbosch, nine (0,73 %) were positive for *Brucella ovis*. In the Highveld Region 69 samples were examined, 13 of which (18,8 %) were positive.

The Regional veterinary laboratory at Middelburg examined 1 751 samples, 5,2 % of which were positive.

It therefore appears that the Rev. 1 vaccine is used fairly extensively in the intensive sheep-farming areas of the Republic.

Infectious epididymitis/vaginitis ("epivag")

At the Cato Ridge Abattoir in the Natal Region, 19 bovine carcasses were condemned for peritonitis caused by infectious vaginitis.

A positive diagnosis was made in two herds in the Free State Region.

The State Veterinarian, Louis Trichardt, estimated that 40 % of herds examined by him, on a routine basis, were infected.

Posthitis and necrotic balanitis/ vulvitis

In the Eastern Cape and Karoo Region extensive outbreaks of posthitis occurred among stud rams, which were usually fed on a ration with a high protein content. Necrotic balanitis/vulvitis has again made its appearance, especially among Dorper flocks and the indications are that this condition is spreading.

Fusobacterium necrophorus was fairly regularly isolated from such cases and *Mycoplasma arginini* was occasionally found.

Diseases of calves

White scours

This disease was diagnosed throughout the Republic.

There was a considerable decrease in the number of cases in the Western Cape Region, owing mainly to a sustained extension campaign.

In the Northern and Eastern Transvaal Region one outbreak involving 30 calves occurred in the Louis Trichardt State veterinary area and the two outbreaks, during which there were 10 deaths, in the Barberton State veterinary area.

Paratyphoid

Thirty-one outbreaks occurred in the Natal Region and 80 calves were involved in these outbreaks.

Twenty-nine calves died in the Highveld Region and 81 in the Transvaal Region.

Unfortunately quite a number of calves developed the disease and died after they had been vaccinated with the paratyphoid vaccine. In the Pietersburg district 26 of 48 calves that had been vaccinated developed the disease and 16 eventually succumbed.

Calf diptheria

A few outbreaks were recorded from the Eastern Cape and Karoo, Highveld and Transvaal Regions.

Sweating sickness

In the Natal Region four cases were reported from the Ngotshe and Hluhluwe districts. A single case was diagnosed in the Transvaal Region. Fewer cases than before occurred in the Northern and Eastern Transvaal Region, only 13 cases being reported.

Enteroviruses

No cases of infection with these viruses were reported.

Disease of poultry

The Poultry Diagnostic and Extension Services Section of the Division of Veterinary Services performed more than 6 000 autopsies on poultry during the year under review.

Infectious bronchitis

Outbreaks occurred mainly among broilers in the Natal Region. A few outbreaks were also reported from the Eastern Cape and Karoo, Western Cape, Transvaal and Free State Regions. The virus was also isolated from a few cases of the disease known as "dikkop".

Infectious coryza

A few cases of the disease were confirmed in all the Regions with the exception of the Western Cape and Free State Regions.

Chronic respiratory disease (*mycoplasmosis*)

The Regional veterinary laboratory at Allerton confirmed 63 cases of the disease and the Regional veterinary laboratory at Stellenbosch performed 3 501 tests, 353 of which were positive. The veterinary laboratory at Potchefstroom did 656 post mortems, 21 of which (3,2 %) were positive.

Fowl pox

Sporadic cases occurred in all the Regions except the Highveld Region.

Infectious bursitis (*Gumboro*)

In the Natal Region there were 28 confirmed cases and in the Western Cape Region 64.

The veterinary laboratory at Kroonstad was able to isolate the virus from tissues of clinically normal chicks, thereby proving that a subclinical form of the disease was present in that area.

Epidemic tremor

No cases were reported.

Marek's disease

According to information received from the veterinary laboratory at Kroonstad this disease is still on the increase, despite vaccination of flocks. Of the 1 255 birds autopsied, 597 (47,5 %) showed some form of Marek's disease. Lesions have been observed in a variety of organs, the most important

ones being the nervous system, kidneys and ovaries. The Regional veterinary laboratory at Stellenbosch found that 15 % of hens vaccinated as day-old chicks still contracted the disease at 12 to 14 weeks of age. Twenty-five cases were confirmed in the Natal Region and 22 in the Northern and Eastern Transvaal Region.

Lymphoid leukosis complex

The Regional veterinary laboratory at Stellenbosch reported 11 cases, the Regional veterinary laboratory at Allerton 10, the veterinary laboratories at Potchefstroom and Kroonstad 64 and the State Veterinarian, Lydenburg, 22.

Trichomoniasis

No cases were reported.

Viral arthritis

Viral arthritis caused by a reovirus was encountered in broilers at 6 weeks of age in the Western Cape Region. Although mortality was less than 5 %, no less than 20 % of the birds were affected with resultant poor feed conversion and low masses at slaughtering.

Diseases of pigs

Vibronic dysentery

This disease is endemic in practically all piggeries in the Natal and Western Cape Regions. The disease is controlled by the addition of specific remedies to the rations.

Six outbreaks occurred in the Western Cape Region and 34 samples were examined. Of the samples examined, 13 were microscopically positive for *Treponema hyodysenteriae* and the organism was isolated and cultured from six of the samples.

Respiratory disease syndrome

A few outbreaks occurred in the Western Cape Region but were speedily brought under control by the improvement of management practices.

A survey undertaken at Spekenam showed that 3 583 (19,2 %) of the 18 691 lungs examined had lesions. Pathogenic organisms isolated from the lungs were *B. bronchiseptica*, *Haemophilus spp.*, *Pasteurella multocida* and a variety of *Mycoplasma spp.* Cultures of *Mycoplasma* organisms were obtained from 88 of the 240 lungs used for culturing.

It would seem that certain genetic strains of pigs are more susceptible to lung infections than others.

An experimental *P. multocida* vaccine was prepared for a single piggery by the Veterinary Research Institute.

Spirochaetosis

No cases were reported.

"Smedi"/Parvovirus infection

Six outbreaks of the disease were investigated in the Western Cape Region. Approximately 25 % of sows were affected. The exposure of young sows and non-pregnant sows to faeces and afterbirth material of older sows was again emphasised.

Dimple skin

An unknown skin condition was encountered on a large piggery near Franschoek in the Western Cape Region.

The lesions shown were bilateral, symmetrical dimples in the skin and a marked thickening of the fat layer. Of a total of 314 young pigs, 124 were affected.

The management of the piggery is exceptional and the only abnormal conditions which could have a bearing on this phenomenon were an exceptionally hot summer, a partial interruption of the water supply for two days, and retarded growth of the pigs.

DEFICIENCY AND NUTRITIONAL CONDITIONS

Supplementary feeding and the use of stock licks did a great deal to reduce nutritional problems.

Phosphate deficiency was common in the Free State, Highveld and Transvaal Regions, and in the coastal belt of the Eastern Cape and Karoo Region. Cases of 'stiffsickness' (aphosphorosis) were encountered in the Vryburg, Kuruman, Kimberley and Potchefstroom districts. Bladder stones caused problems among rams and wethers in the coastal belt of the Eastern Cape and Karoo Region.

A *copper* deficiency caused swayback in lambs in the Districts of Hermanus and Caledon. In the Potchefstroom district piglets showed a posterior paresis and investigations showed a 10 to 20 ppm copper level instead of the normal 200 ppm. A copper deficiency was also encountered in sheep in the Calvinia State Veterinary area, the sandveld area along the West coast and the coastal area of Bredasdorp.

Manganese deficiency occurred in the districts of Moorreesburg and Kimberley. In the districts of Tarkastad and Aliwal North cattle and sheep showed symptoms of acute tremor. This condition was found to be due to *magnesium* deficiency. Deficiencies also occurred in the Bethlehem, Fouriesburg and Bloemfontein districts.

Zinc deficiency in pigs in the Bloemfontein district was reported.

An *iron* deficiency was encountered in pigs in the Namaqualand district and the Kimberley State veterinary area.

Selenium deficiency in sheep was diagnosed by the State Veterinarian, Kimberley, on the Vaalharts Irrigation Scheme.

Cases of Vitamin B6 deficiency occurred among chicks in the De Aar district.

A *Vitamin E* deficiency was diagnosed in calves in the Piet Retief district.

Mortality among goats occurred in the Transvaal Region owing to *Vit. B1* deficiency (cerebrocortical necrosis).

A considerable number of cases of *pregnancy toxæmia* (domsiekte) were reported in the Western Cape, Free State, Highveld, Transvaal and Eastern Cape and Karoo Regions.

A few cases of *milk fever* occurred in the Free State, Transvaal and Eastern Cape and Karoo Regions.

A few cases of *acidosis* were diagnosed in the Free State, Highveld, Northern and Eastern Transvaal and Transvaal Regions.

Owing to insufficient grazing and a lack of water 46 cattle died in the Mamre coloured area, 17 sheep in the Malmesbury district and 14 sheep in the Piketberg district.

Twelve horses belong to the SADF Equestrian Centre at Potchefstroom were treated for *azoturia* (Monday morning disease). One horse died.

POISONING

Mineral poisoning

Carelessness or the accidental intake of poison again accounted for substantial mortality among livestock.

In the Eastern Cape and Karoo Region 24 rams died of *arsenical* poisoning after being dosed with a remedy supposed to be effective against prussic acid poisoning. An unknown number of cattle died of *arsenical* poisoning in the Indwe, Wodehouse and Cathcart districts.

An anthelmintic remedy containing arsenic was responsible for the death of 60 lambs in the Tarkastad district. In Gazankulu 46 head of cattle died of *arsenical* poisoning.

Urea poisoning caused mortality in all the Regions with the exception of the Natal and Eastern Cape and Karoo Regions. In the Western Cape Region urea poisoning accounted for the death of 549 sheep and five dairy cows. Four cattle died in the Free State Region and in the Highveld Region eight eland, one oryx, eight springbuck and one black wildebeest died after partaking of a lick which was supposed to be free of urea but when analysed showed a 13 % urea content. Five cattle also died after a lick containing urea had been saturated by rain.

Thirty cattle and 22 sheep died in the Transvaal Region and seven cows in the Northern and Eastern Transvaal Region.

Chlorinated hydrocarbons caused the death of nine cattle in the Natal Region. In the Highveld Region *dieldrin* was responsible for the death of 19

cattle and 2 horses and *BHC* for the death of six calves. *Dieldrin* was also responsible for the death of five dairy cows in the Northern and Eastern Transvaal Region. In the Free State Region 117 sheep died after being dosed with *Terenol* which had been maliciously polluted with *dieldrin*.

Organophosphatic pesticides caused mortality in the Natal (seven cattle), Western Cape (seven cattle), Free State (two cattle), Transvaal (125 cattle), Eastern Cape and Karoo (two dogs) and Northern and Eastern Transvaal (nine cattle) Regions.

The following substances also caused poisoning:

Copper in the Natal (one sheep), Western Cape and Eastern Cape and Karoo Regions.

Lead in the Free State (five calves) and Eastern Cape and Karoo (seven cattle) Regions.

Warfarin in the Natal Region (one horse).

Nitrate in the Western Cape Region (15 calves).

Fertiliser in the Northern and Eastern Transvaal Region (seven warthogs and 25 guinea-fowl).

Strychnine poisoning again caused the death of dogs throughout the Republic.

Plant poisoning

The following plants were responsible for livestock losses in the various Regions.

Natal Region

Homeria and Moraea spp. (tulp) 268 cattle), *Lantana camara* (62 cattle), *Senecio* spp. (sprinkaanbos) (24 cattle and 17 sheep), *Dichapetalum cymosum* (gifblaar) (17 cattle), *Matricaria nigellaefolia* (staggers) (8 cattle) *Tribulus terrestris* (common dubbeltjie) (25 sheep), plants containing *prussic acid* (five cattle, 11 sheep).

Western Cape Region

Galenia africana (kraalbos), *Cotyledon* spp. (krimpsiekte) (1471 sheep), *Melanthus* spp. (kruidjie-roer-my-nie), *Lantana camara* (8 sheep), *Cynanchum capense* (dronktou), *Ornithogalum* spp., *Trachyandra divaricata*, *Tribulus terrestris* (common dubbeltjie), plants containing *prussic acid* (541 sheep).

Free State Region

Homeria and Moraea spp. (tulp), *Melanthus* spp. (kruidjie-roer-my-nie), *Nerine laticoma*, *Dipcadi glaucum* (poison onion), *Ornithoglossum* spp. (slangkop), *Geigeria* spp. (vermeersiekte), *Crotalaria* spp., *Amaranthus* spp., *Tribulus terrestris* (common dubbeltjie), *Chrysocoma* spp., plants containing *prussic acid*.

Highveld Region

Pachystigma pygmaeum (gousiekte) (50 cattle, 10 sheep), *Sesbania*, *Ornithoglossum* spp. (slangkop), *Homeria* and *Moraea* spp. (tulp), plants containing *prussic acid*.

Eastern Cape and Karoo Region

Homeria and *Moraea* spp. (tulp), *Senecia* spp. (sprinkaanbos), *Tribulus terrestris* (common dubbeltjie), *Cynanchum* spp. (Klimop, bobbejaantou), *Amaranthus* spp. *Chrysocoma tenuifolia* (kaalsiekte, bitter Karoo), *Cotyledon* spp. (Krimpsiekte), *Argemone subfusiformis* (Mexican poppy), *Galenia africana* (kraalbos), *Melica terrestris* (dronkgras), *Lasiospermum bipinnatum* (ganskweek), plants containing *prussic acid*.

Transvaal Region

Dichapetalum cymosum (gifblaar), *Homeria* and *Moraea* spp. (tulp), *Lantana camara*, plants containing *prussic acid*.

Northern and Eastern Transvaal Region

Senecio spp. (sprinkaanbos), *Acacia nilotica* (lekkerruikpeul), *Fadogia* spp. (gousiekte), *Homeria* and *Moraea* spp. (tulp).

Toxins

Appreciably fewer cases of *Diplodia maydis* poisoning occurred.

Only 24 cases were reported in the Highveld Region and 10 in the Natal Region.

Two oxen died in a feedlot in the Northern and Eastern Transvaal Region. Fungi *rhizopus* and *Aspergillus* spp.) were isolated from the ration.

INTERNAL PARASITES

Morbidity caused by internal parasites varied according to climatic conditions.

Internal parasites remain a problem, on account of not only the deaths they can cause but also the indirect losses as a result of the condemnation of certain organs at abattoirs.

Haemonchus spp. (wireworm) was again the most common parasite in all the Regions. In the Ciskei 474 374 sheep and 379 796 goats were dosed for internal parasites.

Oesophagostomum spp. (nodular worm) was likewise an important parasite in all Regions with the exception of the Eastern Cape and Karoo Region. In the Natal Region 183 924 lots of sheep intestines were condemned at abattoirs on account of nodular worm infestation. The parasite was also diagnosed in pigs in the Western Cape Region.

Trichostrongylus spp. (bankrupt worm) was diagnosed in the Barberton State veterinary area, where 200 steers were badly infested.

Ostertagia spp. (brown stomach worm) infestation was diagnosed in the Eastern Cape and Karoo Region.

Dictyocaulus spp. (lungworm) infestation was observed in springbuck in the Ficksburg district.

Paramphistoma spp. (conical fluke) infestation occurred throughout the Highveld Region and caused mortality in the Bethlehem State veterinary area. The parasite also occurred in the Western Cape and Eastern Cape and Karoo Regions.

Fasciola spp. (liver fluke) was responsible for the condemnation of 32 109 bovine and 58 152 sheep and goat livers at abattoirs in the Natal Region. In the Transvaal Region 13 % of the 104 000 bovine livers examined at the Pretoria abattoir were found to be infested. In the Johannesburg State veterinary area 9 % of the 712 000 bovine livers examined at abattoirs in the area were condemned. In conjunction with *Senecio* poisoning this parasite was responsible for considerable livestock losses in the Eastern Cape and Karoo Region. The parasite also occurred in the Highveld and Western Cape Regions.

Stilesia hepatica (liver tapeworm) occurred throughout the Republic. In the Natal Region it was responsible for the condemnation of 125 991 sheep and goat livers at the Cato Ridge abattoir. At the City Deep abattoir in Johannesburg 27,6 % of all sheep livers were condemned as a result of this parasite.

The incidence of *measles* remained high in cattle in the Transvaal Region (7,5 % at the Pretoria abattoir and 3,4 % at the City Deep abattoir). The incidence in pigs was much lower, namely 2 %.

Many of the cattle that originally came from SWA and were fattened in feedlots in the Western Cape Region were condemned for measles. In the Free State Region measles was a problem among cattle and pigs, especially in the Vryburg district.

Trichinella spiralis was found in three lion and seven hyena carcasses in the Kruger National Park.

Parafilaria bovicola infestation was diagnosed in cattle in the Eastern Cape and Karoo Region. These cattle were introduced from the Northern Transvaal. Infestation is on the increase in the Vryburg State veterinary area. In the Louis Trichardt State veterinary area 8 % of the herds were visibly infested and in the Letaba district the figure was 5 %. The parasite was also commonly found in the Rustenburg State veterinary area.

Ascaris lumbricoides was again diagnosed in pigs in the Western Cape Region after having been absent from the Region for many years.

Tapeworm infestation in cattle and small stock was widespread.

Coenurus cerebralis cysts were the cause of a considerable number of deaths among sheep in the Eastern Cape and Karoo Region.

EXTERNAL PARASITES

External parasites, and especially ticks, were again troublesome. According to recent reports from the Regions, ticks remain the most important external parasite.

The blue tick *Boophilus* spp. was active in all the Regions. The same applies to the brown ear tick *Rhipicephalus appendiculatus* which was very troublesome in the Transvaal and Highveld Regions.

The redlegged tick *R. evertsi* was very prevalent in the coastal areas of the Eastern Cape and Karoo and Natal Regions.

Hyalomma spp. (bontlegged tick) was very troublesome in the Western Cape, Transvaal, Free State, Natal, Highveld and Northern and Eastern Transvaal Regions.

Amblyomma spp. (bont tick) was limited to the Eastern Cape and Karoo, Northern and Eastern Transvaal and Transvaal Regions.

Ixodes rubicundus (Karoo paralysis tick) was very active during the autumn months in the Ceres Karoo, Citrusdal, Calvinia and Clanwilliam districts and in the Piketberg Sandveld. This tick was also troublesome in the Eastern Cape and Karoo and Free State Regions.

The occurrence of a new species of tick *Rhipicephalus macalatus* in the Natal Region is being investigated.

Sheep lice, particularly *Damalina ovis*, were very prevalent in the Eastern Cape and Karoo, Highveld, Transvaal and Natal Regions.

The effect the compulsory dipping campaign against sheep scab had on the lice population can as yet not be determined.

The incidence of *Psorergates ovis* (Australian itch mite) is on the increase in the Free State Region but reports received from the Western Cape Region indicate that there is a decrease in the incidence in this Region. In the Eastern Cape and Karoo Region an infestation of 80% was found on one farm.

Goat ear mange caused by a *Psoroptes* spp. occurs sporadically in the Coloured settlements in Namaqualand.

Blowfly strike was again a problem in the Western Cape and Eastern Cape and Karoo Regions.

Simulium spp. (midges) occurred sporadically along the banks of the Orange River.

Stomoxys calcitrans (stable fly) was very troublesome in the Western Cape, Free State, Transvaal and Highveld Regions.

Demodex infestation was diagnosed in dogs throughout the Republic and in a blue wildebeest (gnu) in the Kruger National Park.

ARTIFICIAL INSEMINATION

The testing of bulls at AI centres in the Natal, Western Cape and Eastern Cape and Karoo Regions was carried out by officers of the Regional

veterinary laboratories at Allerton (Natal) and Stellenbosch (Western Cape) and the veterinary laboratory at Grahamstown. All other AI bulls were tested, as in the past, by the Section for AI and Reproduction of the Division of Veterinary Services, in conjunction with the Veterinary Research Institute. After all the results of the tests have been analysed, the final recommendation on the registration or re-registration of AI bulls rests with this Section. During the year under review 547 bulls were tested.

Leptosphira hardjo was diagnosed serologically in two bulls. These bulls were isolated and treated and will be re-tested. One bull was rejected when he reacted positively to tests for *Brucella abortus*, *Trichomonas foetus* and *Campylobacter foetus*.

Trichomonas foetus was diagnosed in another bull. After treatment in quarantine and retesting the bull was found to be negative and re-admitted to the centre.

Two bulls were condemned on account of sperm abnormalities, one on account of an abscess in a seminal vesicle and another for bilateral degenerative atrophy of the testis.

Of the 304 bulls at private centres, 57 (18,75%) were serologically positive for infectious pustular vaginitis.

At present there are 51 dairy breed bulls at various stages of progeny testing. Forty-three beef breed bulls are at various stages of performance testing.

The total number of doses of semen sold by AI centres during 1979 was 541 346 (529 718 in 1978). Of this number 420 390 were from dairy breed bulls and 120 956 from beef breed bulls. During the year under review AI centres collected 79 956 doses of semen from 284 privately owned bulls for use by their owners.

The breed classification of AI bulls from which semen was collected is as follows:

Friesian 126, Jersey 30, Brahman 18, Simmentaler 10, Hereford 9, Ayrshire 7, Bonsmara 6, Guernsey 4, Sussex 4, Santa Gertrudis 4, Africander 4, Aberdeen Angus 4, Drakensberger 3, Beef Shorthorn 2, Limousin 1, Pinzgauer 1, Brown Swiss 1, Red Poll 1, Charolais 1.

Since the promulgation of the Livestock Improvement Act, 1977 (Act 25 of 1977), 38 cows have been registered as ovum donors. These cows must be free of brucellosis and tuberculosis and clinically normal and healthy, without any visible hereditary defects. The general management and reproductive efficiency of the herd of origin must be acceptable.

STOCK INSPECTION SERVICES

There was no improvement in the staff position as regards stock inspectors. Of the 585 posts, 143 (24,4%) were still vacant. During the year under review 65 new appointments were made, 70 officials resigned and 5 deaths occurred. Of the officials serving at present, 60,9% are above the

TABLE 3 - AI courses and number of successful candidates

Courses offered	Registerable inseminators		Owner inseminators		Labourers	
	Courses	Successful candidates	Courses	Successful candidates	Courses	Successful candidates
AI and Reproduction Section	2	18	4	89		
SV Potchefstroom	3	31	5	181		
SV Mossel Bay			1	8		
SV Bloemfontein			3	62		
Other bodies (Taurus, Spermoa)			128	984	10	344
Training centre at Boskop					13	103
Total	5	49	141	1 324	23	447

age of 50 years, 61 % have less than 10 years' service and 23 are above the age of 65 years.

ANIMAL HEALTH EXTENSION SERVICE

Officers of the Division of Veterinary Services continued to render extension services to farmers. In addition to the Division's contribution to the training of prospective farmers at colleges of agriculture and the compilation of leaflets and circulars, the following tasks are undertaken:

Farmers' days are arranged and addressed, articles are published in local papers, agricultural magazines and journals, farmers' unions and study groups are addressed, radio talks are compiled, short courses on stock diseases are offered and programmes for vaccination and dosing are drawn up. Even the television service is utilised.

Individual farmers are given advice by State Veterinarians and Stock Inspectors on farming and veterinary problems, improved farming practices new vaccines and the advantages to be gained by joining disease eradication schemes, such as the bovine tuberculosis and brucellosis eradication schemes.

IMPORT AND EXPORT CONTROL

Import control

To prevent the introduction of stock diseases from other countries, the Division uses quarantine stations for animals and birds. There are quarantine stations at Jan Smuts Airport and at the harbours at Durban, Cape Town and Walvis Bay.

The following animals and insects were imported:

At Jan Smuts Airport a dog and a cat introduced illegally into the country were sent back to the country of origin.

One bovine introduced illegally from Botswana was destroyed and the owner was charged and fined R50. The following animals and products were confiscated:

1 rabbit, 1 bird, 5 reptiles, 60 eggs, 15 kg of meat and 4,585 kg of biltong. These were all confiscated and destroyed.

	From neighbouring territories	From overseas
Cattle	3 122	17
Horses	67	40
Donkeys	7	-
Sheep	10	7
Pigs	231	-
Dogs	389	825
Cats	268	286
Poultry	5 800	300
Birds	330	11 421
Game	1 786	29
Rabbits	3	-
Monkeys	-	4
Reptiles	10	192
Rodents	307	79
Tropical fish	1 144 832	200 000
Flies and dung-rollers	200	

Numerous different products were imported under permits issued by the Division.

Export control

Officers of the Division of Veterinary Services carried out veterinary examinations for export purposes and issued certificates, in accordance with the requirements of importing countries, in respect of the following animals:

	To neighbouring territories	To overseas countries
Cattle	63 716	6 109
Equines	1 915	78
Sheep	37 413	174
Goats	13 754	194
Pigs	2 376	-
Dogs	744	887
Cats	100	217
Poultry	807 925	384 468
Birds	277	72 295
Game	619	93
Reptiles	73	101
Marine animals	-	104

A large variety of products were exported.

TRAINING

State Veterinarians of the Division gave lectures on veterinary science at all the colleges of agriculture.

The in-service training of members of the inspectorate staff was continued, and one course for 21 officials was held during the year. Since September 1972, 617 officials have been trained in this way. No courses in administering tuberculin tests were held for officials of the inspectorate staff during the year under review.

LEGISLATION

During the year under review two government notices were published under section 27 (1) of the Animal Diseases and Parasites Act, 1956 (Act 13 of 1956). Government Notice R.471 of 14 March 1980.

Regulations relating to the control of bovine tuberculosis. This regulation came into operation on 1 April 1980.

Government Notice R.2028 of 14 September 1979, *Amendment of Standing Regulations.* Certain parts of the *Standing Regulations* published in Government Notice R.1531 of 4 October 1963 were amended to make provision for the compulsory dipping of sheep for sheep scab.

TECHNICAL RELATIONS WITH OTHER COUNTRIES

Liaison and co-operation with African countries

The Head Office of the Division was visited by scientists from Bophuthatswana, Transkei, Venda and Zimbabwe. Officers from Head Office paid visits to Botswana, Transkei and Swaziland.

Liaison with overseas countries

Scientists from New Zealand, Australia, Great Britain, Italy, the United States of America, Paraguay, Spain and Mauritius visited the Head Office of the Division.

The Regional veterinary laboratory at Stellenbosch was visited by 10 overseas scientists. The visitors came from Great Britain, the United States of America, West Germany and Paraguay.

The Regional veterinary laboratory at Middelburg (CP) received four visitors from Britain and the United States of America.

CLINICAL SERVICES

State Veterinarians rendered veterinary services to all State-owned herds and flocks, and also performed clinical work for farmers whenever their official duties permitted, especially in areas where there were no private veterinary practitioners.

During the year State Veterinarians received R15 913 for professional services and R5 810 for travelling expenses. Vaccines to the value of R3 087 were sold by State veterinary offices. Fees for

laboratory investigations amounted to R13 356 and those for meat and game carcase inspections to R411 907.

Fees for keeping animals and birds in quarantine amounted to R20 792 and sundry revenue to R17 116.

The Division received R309 216 for the carcasses of animals slaughtered in accordance with the bovine tuberculosis eradication scheme and approved for human consumption. The grand total of the revenue received by the Division of Veterinary Services was R797 197.

DIAGNOSTIC SERVICES

Apart from diagnostic services rendered by State Veterinarians in their own areas, the Division has four regional veterinary laboratories, viz. at Middelburg (CP), Stellenbosch, Allerton and Windhoek, as well as smaller veterinary laboratories at Grahamstown, Queenstown, Kroonstad and Potchefstroom. An additional laboratory at Skukuza enables the Division to keep track of animal diseases occurring in game in the Kruger National Park. Furthermore, the Poultry Diagnostic and Extension Services Section and the AI and Reproduction Section of the Division at Onderstepoort offer a more comprehensive service to poultry and cattle farmers. These laboratories render a great deal of assistance to both State Veterinarians and private veterinarians and have come to play an increasingly important part in extension.

As Table 4 shows, there was a 32,4 % decrease in the diagnostic services rendered by the Division. The decrease was mainly the result of the absence of officials for a period of 4 months while they were busy with the compulsory dipping campaign against sheep scab.

MEAT HYGIENE

ADMINISTRATION

Abattoirs

At the end of March 1980, there were 779 red meat abattoirs, 260 poultry abattoirs and 14 rabbit abattoirs registered in South Africa. These abattoirs were graded as follows:

Region	Red Meat			Total	Poultry	Rabbits	
	A	B	C		D		
Tvl	11	14	31	16	72	51	3
N & E Tvl	2	10	26	42	80	11	1
Highveld	2	11	30	17	60	36	-
OFS	2	2	35	37	76	38	-
Natal	4	8	22	20	54	54	5
EC & K	2	9	42	35	88	35	4
W Cape	2	14	48	42	106	35	1
KwaZulu	-	-	2	72	74	-	-
Lebowa	1	-	5	123	129	-	-
Gazankulu	-	-	1	39	40	-	-
Total	26	68	242	443	779	260	14

TABLE 4 - Diagnostic Services

	1978/79	1979/80
<i>Brucella</i> Rose Bengal tests	259 964	149 385
<i>Brucella</i> Complement fixation tests	56 041	42 385
<i>Brucella</i> tube agglutination tests	71 144	29 871
<i>Brucella</i> milk ring tests	3 936	2 041
<i>Brucella</i> rivanol tests	149	-
<i>Brucella</i> mercapto-ethanol tests	149	-
FA tests	2 249	2 027
PPLO tests	14 913	10 149
BWD tests	7 717	387
HI tests	30 507	26 124
Gumboro serological tests	5 731	3 698
Adenovirus serological tests	-	-
Poultry <i>Mycoplasma</i> isolations	4 611	369
Bovine <i>Mycoplasma</i> isolations	-	2
Vibriosis	1 009	308
Trichomoniasis	894	306
Johne's disease	7	4
Leptospirosis	280	1 380
<i>Actinobacillus seminis</i>	31 066	13 110
Pasteurellosis	724	353
Chlamydiosis	1 103	392
<i>Chlamydia</i> isolations	117	107
Antibiograms	2 145	1 092
Serotyping of cultures	683	1 374
Skin scrapings	462	439
Faeces examinations	19 502	7 743
Larval cultures	14	437
Identification of internal parasites	2 512	1 791
Identification of external parasites	611	189
Identification of plants	88	86
Mastitis milk examinations	29 276	32 918
Semen	12 890	6 028
Sheath washings	1 170	1 437
Vaginal swabs	1 101	1 646
Placentas	74	72
Aborted fetuses	554	283
Haematology	8 913	10 608
Biochemical	46 200	31 508
Toxicology	578	333
Dipping samples tested	133	200
Protozoological	64	559
Bacteriological	43 218	33 954
Virological	5 810	1 060
Biological	401	515
Histopathological	2 195	1 536
Abattoir by-products tested	726	1 076
Abattoir bacterial counts	2 491	564
<i>Trichinella</i>	197	120
Smears	11 406	10 446
Clinical examinations	9 615	33 007
Post mortem examinations (poultry excluded)	3 709	3 312
Post mortem examinations (poultry)	12 662	10 634
Poultry samples examined	17 677	13 250
Antibiotic residues tests	-	212
Dourine tests	-	2 339
<i>Coxiella burnetii</i>	-	9
Examination of perinatal lambs	-	28
Pig <i>Mycoplasma</i> isolations	-	88
Total	729 388	493 291

As Venda became independent during the year under review, Act 87 of 1967 is no longer applicable, and therefore, the 44 abattoirs in that country are no longer included in the registers of the Division.

The closing of older abattoirs and the building and opening of new ones take place throughout the year. The closing of old abattoirs has been the result of the stricter application of the requirements of Act 87 of 1967 and the Standing

Regulations promulgated under the Act. Exemptions are now granted only in very exceptional circumstances, with the result that pressure can gradually be exerted on owners to comply with all the requirements relevant to their specific abattoir.

The date by which all abattoirs have to comply with the requirements of the Act is 1984-12-31 - a deadline which is fast approaching. The Abattoir Commission has played an important part by refusing to approve partial improvement projects.

Sterilising plants

Sterilising plants are registered under Act 36 of 1947. This Act is still applicable in South-West Africa. Re-registration takes place annually and a recommendation is required from an officer of this Division (State Veterinarian). Each plant is inspected at least once a year.

Regular bacteriological monitoring of the manufactured products is carried out in the form of the monthly collection of sterile samples and the analysis of such samples in laboratories, including those at the Veterinary Research Institute at Onderstepoort and the Regional veterinary laboratories.

Planning

The evaluation of abattoir or meat processing plant plans has become a very important function of the Meat Hygiene Section and one which it is frequently called upon to perform. The Abattoir Commission submits all plans to this Section for evaluation and recommendations on the hygienic aspects. Consultants and owners make frequent use of this service by requesting meetings to discuss new projects.

The following figures show the number of plans dealt with:

(a)	Sets of plans for new projects	122
(b)	Sets of plans for improvement projects	113
Total		235
(c)	Formal discussions	119
	Projects include: red meat, poultry, rabbit, ostrich and venison abattoirs, boning factories, cold stores and sterilisation plants	
(d)	At the time of planning it was estimated that the red meat abattoirs would cost R50 million	

It is essential that site inspections should be carried out at various stages of construction of new projects in order to improve evaluation.

TABLE 5 - Stock Census

Region or national state	Cattle	Sheep		Goats	Horses	Donkeys	Pigs and mules	Fowls	Dogs
		Woolled	Non-woolled						
Western Cape	373 374	3 215 061	1 324 875	318 636	17 916	8 288	220 544	7 710 046	42 041
Eastern Cape and Karoo	993 606	8 056 924	1 674 939	1 388 331	32 075	9 049	69 492	3 220 926	69 115
Transvaal	2 145 969	2 879 187	330 483	84 988	36 244	8 993	245 812	9 361 502	406 035
Natal	1 488 746	1 060 750	111 744	114 552	25 052	2 981	128 348	3 493 096	139 975
Free State	1 669 600	3 084 545	5 520 110	449 815	45 614	13 412	87 347	754 069	60 787
Highveld	2 122 986	2 738 753	396 760	48 217	51 355	3 811	206 369	3 611 654	128 759
Northern and Eastern Transvaal	1 114 132	244 132	173 651	121 607	8 742	12 466	86 294	999 332	49 848
Total	9 908 413	21 279 352	9 532 562	2 526 146	216 998	59 000	1 044 206	29 150 625	896 560
Gazankulu	199 595	-	2 620	83 503	10	5 141	17 449	272 813	22 435
Lebowa	480 519	Not given separately	89 206	337 182	161	37 118	39 712	354 743	31 157
KwaZulu	1 467 531	56 634	96 180	581 939	12 668	28 737	32 378	1 000 770	138 483
QwaQwa	15 296	Not given separately	2 485	11 803	549	68	190	24 100	1 076
Ciskei	184 666	249 719	Not given separately	226 509	5 067	713	16 525	118 740	17 340
Total	2 347 607	306 353	190 491	1 240 936	18 455	71 777	106 254	1 771 166	210 491
Grand total	12 256 020	21 585 705	9 723 053	3 767 082	235 453	130 777	1 150 460	30 921 791	1 107 051

TABLE 6 - Distribution of cattle

Region or Black State	White owners	Black owners
Western Cape	368 014	5 360
Eastern Cape and Karoo	952 456	41 150
Transvaal	1 973 911	172 058
Natal	1 212 428	276 318
Free State	1 642 185	27 415
Highveld	2 017 481	105 505
Northern and Eastern Transvaal	1 021 107	93 025
Total	9 187 582	720 831
Gazankulu	-	199 595
Lebowa	-	480 519
KwaZulu	-	1 467 531
QwaQwa	-	15 296
Ciskei	-	184 666
Grand total	9 187 582	3 068 438

Abattoirs	Closed	Opened
Red Meat	70	35
Poultry	21	16
Rabbit	3	2
Total	94	53

	No. of sterilising plants
Republic of South Africa	
Transvaal	21
Northern and Eastern Transvaal	4
Highveld	6
OFS	11
Natal	8
Eastern Cape and Karoo	8
Western Cape	22
Total	80
South-West Africa	19

Meat imports/exports

Imports (kg)	Neighbouring States	Overseas	Total
Product			
Red meat/meat products	132 540	1 282 500	1 415 040
Beef	1 240 000	320	1 240 320
Processed beef	12 241	-	12 241
Pork	650 carcasses	-	-
Guinea fowl/Turkeys	24 166	-	24 166
Poultry	-	53	53
Biltong	4 945	-	4 945
Exports (kg)	Neighbouring States	Overseas	Total
Product			
Poultry meat	165 255	15 927 990	16 093 245
Pork	51 877	1 282 553	1 334 430
Mutton	32 874	-	32 874
Venison	-	653 628	653 628
Ostrich	-	96 760	96 760
Beef	2 249 835	9 550 508	11 800 343
Red meat	3 782 637	7 908 870	11 691 507
Canned/processed red meat	13 339	37 710	51 049
Total	6 295 817	35 458 019	41 753 836

Legislation

During the year under review the following Government Notices were published under the Animal Slaughter, Meat and Animal Products Hygiene Act, 1967 (Act 87 of 1967):

- (i) G.N. R.2671 of 30.11.1979, which made provision for the marking of carcasses passed fit for human consumption with methyl violet. This brought the type of marking ink used by the meat inspectors of this Division into line with the requirements of EEC member countries.
- (ii) G.N. 211 of 8.2.1980, governing the new grading system for abattoirs. The red meat, poultry and rabbit abattoirs are now classified into 5 different grades, viz. A, B, C, D and E,

depending on daily throughput. Preparations are being made for regrading all abattoirs in the Republic of South Africa according to the new system, but it will be some time before it is finalised.

Exemptions

The numbers of abattoirs granted further exemption during the period under review are given below. The increase is the result of the fact that more regular inspections are carried out and of the stricter enforcement of the requirements of Act 87 of 1967 and the Standing Regulations promulgated under the Act.

Transvaal - 5; Northern and Eastern Transvaal - 3; Highveld - 3; OFS - 6; Natal - 2; Eastern Cape and Karoo - 1; Western Cape - 9. Total 29

MEAT INSPECTION SERVICES

The total number of animals slaughtered at abattoirs in South Africa is as follows:

Cattle (including calves)	2 124 686
Sheep/goats	5 360 719
Pigs	996 989
Horses	2 920
	8 485 314

The total numbers of animals slaughtered and subjected to post mortem examination by inspectors of this Division are shown in the following table.

	Cattle and calves	Sheep/Goats	Pigs	Horses	Game
Tvl	855 658	1 537 396	265 026	2 218	-
Northern and Eastern Transvaal	-	-	-	-	-
Highveld	-	-	-	-	34 924
OFS	73 883	284 872	17 333	-	-
Natal	185 937	755 069	144 787	-	-
Eastern Cape and Karoo	461 350	107 794	-	-	-
Western Cape	-	-	50 665	-	21 120
Total	1 596 827	2 685 131	477 811	2 218	56 044

TRAINING

Continuous, organised training is recognised throughout the world as necessary for the efficient functioning of any progressive organisation. The Division has embarked on a meat and abattoir hygiene training programme. Four such courses have been held and they were attended by representatives from industry, municipalities and the Department of Prisons. Each course was limited to 20 persons. Judging from the response from the participants the courses were very successful.

Since in-service training for officers is considered more important, courses on meat and abattoir hygiene have been arranged for officers of this Division for the coming year.

GRAZING UTILISATION RESEARCH

NATURAL GRAZING

In most of the pasture areas the rainfall during the year under review was below normal and was sporadic. It was established, for instance, that the production of natural veld in the Karoo was about 50 per cent lower than during the previous growing season.

In a stocking rate trial in the Northern Cape the total live mass production per unit area decreased as a result of the drought, namely from 53,5 kg/ha during the previous season to 43 kg/ha during the year under review. Despite the unfavourable climatic conditions excellent establishment of the pasture crops *Osteospermum sinuatum*, *Atriplex semibaccata* and *Eriocephalus umbulatus* was obtained on plots on the Oudtshoorn Experimental Farm. Seed of these species is supplied to farmers for the re-establishment of damaged veld on farms in the Winter Rainfall Region.

Secondary plant follow-up studies undertaken on protected plots at the Messina Experimental Farm after the disastrous drought of the sixties are producing illuminating results. On plots with very shallow soil there has been no significant increase in perennial grass species after 16 years.

On Mopani veld with a shallow, gravelly soil it was only after eight years that perennial grass species constituted a permanent part of the cover. On deep, fertile soils, however, perennial grass species made a significant contribution to the basal grass cover after only four years.

During a study undertaken to determine the effect of grazing by various types of stock on the cover and composition of West Coast strandveld, the vegetal cover showed the best response when grazed by goats. It was also found that in the dry bush-grass communities of the Eastern Cape the goat, being a browser, is eminently suited to utilising the bush as a source of feed for meat production.

The research programme at the Adelaide Experimental Plot shows that the bushveld areas of the Republic have considerable potential for meat production, provided goats for meat production are made an integral part of the stock farming system in the bushveld areas.

In the grassveld areas of the Eastern Cape Region it was found that the most important grass species for large stock production are *Themeda triandra*, *Tristachya leucothrix* and *Andropogon appendiculatus*. *Andropogon* is the most important species for sheep.

Grazing studies carried out in the Dohne sourveld showed that for effective utilisation of the grassveld a high stocking density should be applied. *Sporobolus fimbriatus*, *Setaria neglecta*, *Panicum stapfianum* and *Digitaria eriantha* were identified as the most important grass species in the dry sweetveld areas of the Eastern Cape.

The utilisation by stock of *Phragmites australis* (common reed) established at soil conservation works is being investigated in the Karoo Region. Utilisation is not possible during the summer months, when the works contain water, and it appears that in winter the reeds are too dry and overgrown to be grazed by small stock. Cattle do utilise the reeds to some extent during winter.

Data from an investigation undertaken to fix standards in accordance with which the production potential of various veld types in the Free State Region can be predicted were processed. The results show that within the same rainfall area the annual phytomass production of different plant communities and habitats varies widely. In the Central Free State the Arcadia soil series of the Arcadia soil form was identified as the most productive with regard to phytomass production. In general total basal cover and phytomass production were not found to be closely correlated.

Results also showed that, among the same species, production per unit of tussock area may vary greatly on different soils. Although the investigation did identify differences in the relative production capacity of the various veld types and habitats, the data cannot be used without further qualification to lay down standards for resource classification. It has been found that differences in the nutritive value and acceptability (palatability) of grass species in the various veld types do affect animal production. It is therefore possible that plant communities with a relatively low phytomass production potential can nevertheless maintain a higher level of animal production than communities with a high phytomass production.

ARTIFICIAL PASTURES

Legumes

Interest in the cultivation of annual and perennial legumes is increasing and the evaluation of pasture legumes has been extended to several parts of the country. In the Winter Rainfall Region 20 trials for the evaluation of various subterranean clover cultivars *Trifolium subterraneum* and annual *Medicago* species were planted from the Langkloof to Kamieskroon in the north-west. It has been found that on the soils of the Tygerhoek Experimental Farm *M. truncatula* (cv *Jemalong*) and *T. subterraneum* (cv. Geraldton) require a soil phosphorus content of 30 ppm for optimum production.

Annual *Medicago* species were also successfully established under dryland conditions in the Central Free State and re-established from seed reserves in the soil the following season. *Medicago*

truncatula, *M. orbicularis*, *M. polymorpha* and *M. turbinata* species are all relatively frost-resistant in the Central Free State, but *M. scutellata* was killed by frost.

It was confirmed at the Nooitgedacht Research Station that cold weather legumes, such as subterranean clover and serradella, can make an important contribution to the feed flow programme in the summer rainfall areas. Plantings of these crops that were established from October to December produced high quality grazing in late autumn and early winter.

Research results also show that the sweet white lupin *Lupinus alba* can successfully replace soya-beans in the rotational cropping system on soils with low fertility. *Lupinus angustifolius* (cv Unicrop) produced a yield of 17 tons of dry mass/ha as a winter crop in the Waterberg area, and serradella species produced over 7 tons of dry mass/ha.

Legume research was expanded at Rietondale. During the year 24 *Lathyrus* species and cultivars were imported from overseas and planted for evaluation, and a large number of subtropical and temperate species were established in the nursery. The temperate species did well in general, but it was found that the winter temperatures at Rietondale were too low for certain of the perennial subtropical species.

A dry mass yield of over 10 tons/ha was obtained under irrigation from *Ornithopus compressus* (Pitman serradella), *O. sativus* and *O. perpusillus*, and from *Viscia dasycarpa* and *Lathyrus sativus*. The subtropical legumes *Stylosanthes quisenensis* (cv Oxley) and *Aeschynomene falcata* (cv Bargoo) produced over 7.5 tons of dry mass/ha.

Despite good rainfall, the subtropical legumes showed little or no response to lime and phosphorus applications, despite a soil pH of 4.0 (KCl).

The lucerne research programme was continued on dry land and under irrigation. Although 56 imported lucerne cultivars have been tested to date, no single imported cultivar stood out as the most suitable for South African conditions.

Research at the Nooitgedacht Research Station showed that some of the lucerne strains that were selected for their adaptation in sour soils are doing very well. A potassium deficiency is, however, a threat to the survival of lucerne. Other fertilisers that have proved to play an important part in lucerne production are boron and molybdenum.

At the Oudtshoorn Experimental Farm, where lucerne hay and lucerne seed production are being determined at various irrigation intervals and intensities, hay yields increased significantly when irrigation levels were raised from 90 mm to 135 mm and 180 mm. Where the quantities were divided so that half the irrigation water was applied at the beginning of the production period and the other half in the middle of the production period, yields were boosted significantly.

The pea aphid *Acyrtosiphon pisum* occurred on lucerne in very large numbers and did damage. The South African Standard lucerne possesses good genetic resistance to this pest and breeding for resistance has been started.

Grasses

Investigations into the value of finger grasses *Digitaria* spp. as grazing and as foggage for use as hay were continued at Roodeplaat and Potchefstroom this year. At Roodeplaat 50 stoloniferous *Digitaria* selections were compared over a four-year period for yield. The average production for the period under review was 9,8 tons of dry mass/ha.

At Potchefstroom a collection of 101 different finger grass selections was established in a nursery. At the end of March 1980 yields of up to 18 tons of dry mass/ha were obtained from some selections. Young oxen and sheep showed decided preferences for certain selections. Preliminary tests indicate, however, that many of the finger grass selections produce little or no viable seed.

Smuts finger grass as a summer pasture for steers produced an average mass increase of 0,7 kg/day/steer from the beginning of November to the end of March. The average carrying capacity on unfertilised Smuts finger grass was 1,6 steers/ha; on fertilised Smuts finger grass (100 kg of N and 10 kg of P/ha) the figure was 2,2 steers/ha. With the same amount of fertiliser Smuts finger grass was able to support 13,8 Döhne Merino sheep/ha during summer.

In an evaluation of *Cenchrus ciliaris* for beef production in the Central Free State the condition of pregnant heifers on *Cenchrus* pastures was maintained during winter, without any supplementation being given. Results of the investigation indicate that the carrying capacity of dryland *Cenchrus* pastures in the Central Free State is not adequate to maintain one large stock unit per ha throughout the year.

During a growing season in which only 75 per cent of the normal rainfall was recorded, dryland *Antheophora pubescens* pastures in the North-Western Cape maintained a carrying capacity of 2,9 ha/LSU. Results of fertilising trials with *Antheophora pubescens* on several soil types in the North-Western Cape showed that potash fertilising is not required for production. *Antheophora pubescens* responds to both nitrogen and phosphate fertilising and for the highest yields both should be applied. Under dryland conditions a higher phytomass production is obtained with a row espacement of 1,5 m than with a row espacement of 0,75 m.

The pH of the rumen fluid of sheep that had grazed on kikuyu was investigated in the Natal Region. During the period of the investigation pH values of over 7,2 were obtained. The high pH may be partly responsible for the low digestibility of kikuyu.

Cultivation of Midmar ryegrass, which was bred at Cedara, is continuing to expand. Midmar has produced very good results in comparative cultivar trials in Queensland, Australia.

Research in the Eastern Cape has shown that feed shortages in the coastal areas can be overcome during the winter months by the inclusion of temperate grasses in the feedflow programme. The most promising temperate grasses are Italian ryegrass *Phalaris tuberosa* and Kentucky 31. In the winter rainfall area *Phalaris tuberosa* and Kentucky 31 also survived the severe summer drought.

STOCK FEED AND FORAGE CROPS

A yield trial with 18 entries carried out at Rietondale was severely damaged by hail. It was clear that some entries recovered better from the hail damage than others. The growing stage of the crops when the hail occurred undoubtedly played a part with regard to the degree of recovery.

By far the best seed crop was obtained from *Vicia faba*, namely 2,8 tons/ha. The second largest crop was only 1,5 tons/ha, and was obtained from *Pisum sativum arvense*, cv WP₁.

The field peas *P. sativum arvense* performed poorly, with the exception of WP₁, Derrimut and, to some extent, WP₇. *Vicia narbonensis*, *Lathyrus sativus* and *Lupinus albus* produced satisfactory seed crops (over 1 ton/ha). The crops of the two cultivars of *L. albus*, Kiev and Ultra, were the same size, namely 1,4 tons/ha.

Six cow-pea cultivars *Vigna unguiculata* were tested in two field trials, i.e. under irrigation and on dry land.

The trial under irrigation failed as a result of nematode infestation, but the dry land trial produced fairly good results. Saunders Regop produced the highest total dry mass (5,5 tons/ha), but the seed crop of this cultivar was the poorest, namely 800 kg/ha. The seed crops of the other entries varied from 1,2 to 1,7 tons/ha.

In a study in which babala grazing was compared with a hybrid sorghum (Trudan II) and buffalo grass *Cenchrus ciliaris*, it was found that the buffalo grass pasture produced sufficient grazing for 198 animal grazing days/ha per year and an average daily mass increase of 803 g/ox. The babala and Trudan II pastures produced 162 animal grazing days/ha each and an average daily increase of 674 g and 592 g per ox, respectively.

The drought in large areas of the Karoo prompted the planting of drought forage crops such as spineless cactus and old-man saltbush. During the period under review 298 000 spineless cactus leaves and 398 kg of old-man saltbush seed were made available to farmers as planting material. The first seed of a more palatable old-man saltbush selection was released.

This improved old-man saltbush was developed by repeated phenotypic selection for palatability to merino sheep. The seed is produced from 8 palatable clones planted in isolation for seed production.

IV. Agricultural Resource Utilisation

RESOURCE CLASSIFICATION

Survey of land types

The following 151:250 000 land type maps have been printed and are available from the Government Printer:

2522	Bray	2824	Kimberley
2622	Morokweng	3024	Colesberg
2722	Kuruman	2626	West Rand
2822	Postmasburg	2826	Bloemfontein
2722	Prieska	2528	Pretoria
2524	Mafeking	2628	East Rand
2624	Vryburg		
2724	Christiana		

The maps SE 27/20 Witdraai, 2720 Noenieput and 2728 Frankfort, which have already been printed, are being revised and are not available to the public at present.

Five maps are ready for printing, and a further 20 are in the process of preparation for printing. Field work of one kind or another has been done for a further 15 maps.

The inventories for the printed maps are being finalised and should be ready for publication at the end of 1980.

Peri-urban soil surveys

(scale - 1:50 000)

Pretoria-Witwatersrand-Vereeniging (PWV) area (21 maps)

Two maps have reached a final stage of preparation for publication. The field work for five maps has been completed. No field work has been done as yet on four maps for this area.

Irrigation surveys

A detailed study was made of 8 500 ha, and a semi-detailed study of 420 000 ha, for purposes of irrigation development.

AGRICULTURAL METEOROLOGY

Agroclimate

Good progress has been made with all the existing aspects of the agroclimate subproject. The measurement and calculation of radiation has been started on a more extensive scale in the Winter

Rainfall Region, and a drought study in the Karroo Region has also been started.

Influence of weather on crops

Various aspects of the quantification of climatic influences on the growth and production of apples, cotton and maize were researched and good progress was made. A mathematical model to simulate the productivity of pastures was developed and is being tested at Grootfontein.

Improvement of the microclimate

The nature of a crop appears to play a major part in its sensitivity to wind damage. In the case of vegetables it was found that beans showed no response to windbreaks, although muskmelons were very sensitive. A start has been made in determining the effectiveness of high palmette systems as windbreaks.

Agricultural meteorological forecasts

Techniques of forecasting weather conditions unfavourable to the mohair industry are being studied at present. Weather satellite photographs for this study are being received and reproduced at Grootfontein.

IRRIGATION PLANNING

The Irrigation Planning Section is responsible for the co-ordination of information required for the evaluation of areas for irrigation development, and is co-operating closely with a variety of specialised disciplines in other institutes, regions and divisions within the Department and other interested departments and bodies.

Reports on the following schemes were completed during the year under review:

Scheme	Irrigable area (ha)
Breede River	114 333
Joostenbergvlakte	6 137
Lower Crocodile Valley	28 268
Sundays River Part I	12 871
	161 609

Under the Vanderkloof canals (Orange River Project), the farm layout for Sanddraai (14 farms) has been finalised.

IRRIGATION RESEARCH

Water:yield functions for wheat were obtained from 10 years' research results for different climatological areas, namely Vaalharts, the

Springbok Flats, the Loskop Irrigation Scheme and Pretoria. These functions are important for irrigation planning and management at both irrigation scheme and farm level.

Investigations at the Vaalharts Government Water Scheme showed that still only about 50 % of the water delivered to farms for irrigation was directly used by the crops, with a further 17 % of the delivered amount reaching the crops indirectly via the shallow groundwater table.

However, this latter percentage decreases with the installation of sub-surface drainage systems, some 300 of which have been installed for the leaching of 3 000 ha of salinised soil.

A relationship between electrical conductivity of the saline topsoil and wheat yield was also established.

The installation of the large number of relatively shallow drainage systems at Vaalharts suggests the possibility of counteracting detrimental salinisation of soil while simultaneously retaining the beneficial groundwater supply to the crop. However, new research into a safer approach, viz minimising overirrigation on the flood beds and decreasing drainage flow, has been initiated.

Intensive research into crop:water relations has continued at Roodeplaat, where the weighing lysimeters have been used in programs designed to test computer-based irrigation scheduling models and also to detect and predict the onset of water stress in crops.

Relationships between declining soil water status and the reduction in crop growth, evapotranspiration rate, predawn leaf water potential, covered leaf water potential and stomatal conductance have been established for wheat and soybeans.

Weighing lysimeters with citrus trees at Addo have continued to provide comprehensive information on tree water use. Water use figures are beginning to serve as useful indices for irrigating citrus orchards in the Sundays River Valley.

Additional X-ray diffractograms (XRD) have been run on some 500 deferrated clay and silt fractions from type profiles collected during the Natural Resources Survey. A filing system has been established for over 15 500 X-ray diffractograms from the Natural Resources Survey project, collected over the past 10 years. Over 4 000 diffractograms have been interpreted.

Progress has been made towards using differential thermal analysis (DTA), infrared (IR) and various extraction techniques to supplement the conventional X-ray diffraction information, especially where difficulties have been experienced in identifying certain minerals (e.g. gibbsite, chlorite, halloysite; talc, pyrophyllite, anatase etc.).

A computer program for automating the X-ray fluorescence (XRF) apparatus has been completed and progress is being made towards the full automisation of the XRD apparatus for special research applications.

Research into the chemical and mineralogical properties of a range of liming materials and waste products such as fly ash and silica slags has been initiated. The aim is to establish the ameliorative properties of these materials on acid soils, with special attention to the trace element content of these materials.

Work has commenced on a project the aim of which is to increase the availability of fertiliser phosphate on problematic acid soils, selected on the basis of a high phosphate sorption index.

The relationship between phosphate sorption and the extractable silica, aluminium and iron is being investigated with a view to establishing criteria for the selection of the best ameliorant, whether it be lime or silica.

Progress has been made in using mathematical models to predict the quantity and salt content of irrigation return flow and the way this influences the flow and water quality in the Great Fish and Sundays Rivers. Modelling activities are being extended to the Breede River between Brandvlei Dam and Robertson.

An evaluation of the suitability, for purposes of irrigation, of the quality of water in dams throughout the Republic, has recently been completed.

Acid effluents from mine dumps as well as various industrial and municipal effluents are being studied with a view to amelioration and disposal without detriment to the environment. The eventual aim is to compile a manual providing guidelines for the safe disposal of effluents on soil.

Values of a wide range of potentially useful indices of soil structural stability were determined on 3 000 soil samples. The parameter which best typified the anticipated stability of each of a group of soils representing different diagnostic soil horizons was the air:water permeability ratio.

A new approach to describing hydrologic properties of soil was explored with the expression of soil water retention in terms of a general set of equations incorporating two constant values for a given soil material. These values are associated with physical soil properties such as texture.

OTHER SOIL AND WATER STUDIES

Research on the evaluation of phosphorus extraction methods for South African soils has revealed that there are good reasons why standardisation of a method for purposes of giving advice on fertilising is essential. No justification can be found for the fact that at present 12 methods are being used by 27 laboratories in the Republic.

On the basis of the research carried out it is proposed that the ISFEI method be adopted for purposes of reference and communication between bodies in South Africa.

In order to save time and money it is proposed that the laboratories that supply advice on fertilising change to volume extraction



An unusual type of soil conservation work in a badly washed-away donga: because there is no solid rock formation for the usual concrete spillway, the spillway was built with gabions



An excellent example of a State work erected at a carefully selected site in a badly eroded area. The terrain above the weir has silted up and reeds were established. More than 300 similar works have been built in the Republic

techniques instead of mass extraction techniques for routine analyses.

It has been established that growth inhibitors are also present in the straw of South African wheat cultivars, and that these inhibitors may react with nitrites that accumulate in soils to form aromatic nitroso compounds. These compounds may inhibit root growth in wheat at very low concentrations and affect populations of micro-organisms in soils.

This research could lead to a better understanding of production problems caused by monoculture and stubble cultivation practices.

CHEMICAL SERVICES

The Soil and Irrigation Research Institute carried out analyses during the year under review for the following bodies:

Registrar: Act 36 of 1947

Stock feeds: 954 samples analysed
Fertiliser: 27 Group I samples
88 Group II samples
Agricultural remedies: 65 samples

Director: Veterinary Research Institute

Samples of dips: 541 samples

Director: Transvaal Region

Soil: 2 317 samples
Plant material: 2 490 samples
Water: 142 samples

Director: Tobacco Research Institute

Soil: 45 samples

SIRI: Internal service

Soil: 3 987 samples
Water: 794 samples

USE OF FERTILISER

In 1979, 2 687 772 metric tons of fertiliser were used for the cultivation of agricultural crops. This includes 400 287 tons of nitrogen, 191 254 tons of phosphorus and 105 090 tons of potassium.

To counteract soil acidity, 1 646 383 metric tons of agricultural lime and other types of lime were used.

SOIL CONSERVATION

Soil conservation committees

The term of office of all the present soil conservation committees expires on 30 September 1980. After this date the committees will not be automatically established - the community will have to request the establishment of a committee through Organised Agriculture. Although the conservation and improvement of the natural

resources will be the chief concern of the committees, it will be possible to carry out this function successfully only within the framework of optimum land use.

Protection and improvement of agriculture land

During the year under review (financial year) there was a decrease of about R1,5 million in the subsidies paid for completed soil conservation work as against the amount paid during the previous year. The high inflation rate, widespread drought and a general public decline in interest in soil conservation are regarded as the most important reasons.

TABLE 1 - Kinds of work subsidised and amounts paid in the Republic.

	1979/80 R	1978/79 R
Inner camp fencing	199 882	830 112
Stock-watering points	253 312	735 359
Soil reclamation (erosion) fences	30 686	50 248
Soil conservation works	441 849	689 078
Contours	911 732	1 035 719
Brack control	431 735	587 508
	2 269 196	3 928 024

A total amount of around R56 000 000 has been paid in subsidies on completed soil conservation work since 1948.

TABLE 2 - Planning of farms

Region	New plans		Replanning and supplementary planning	
	1979/80	1978/79	1979/80 (Up to* 31 March 1980)	1978/79
Karoo	233	234	227	348
Eastern Cape	46	65	372	484
Natal	23	44	114	127
Free State	111	160	407	551
Winter Rainfall	66	66	272	316
Highveld	281	192	247	301
Transvaal	124	238	153	198
	884	999	1 792	2 325

*The data on farm plans for this year are for the nine months ending 31 March 1980. The previous year reviewed, 1978/79, was a full year of twelve months.

In comparison with other regions, the Highveld Region dealt with an exceptional increase in new plans during 1979/80. The relatively good agricultural conditions on the Highveld are regarded as a major contributory factor to the progress made there. The Karoo and Winter Rainfall Regions did equally well.

Run-off control planning still constitutes a very important aspect of the protection of arable soils. There has been sustained interest in the construction of waterways in the Winter Rainfall Region. Very good progress has been made on the Highveld especially. Sixty-four per cent more waterways were completed than during the previous year. This is the first time more waterways were completed than were surveyed, and it is regarded as an encouraging sign that the available manpower is being more effectively utilised by farmers.

Preservation of agricultural land

The Subdivision of Agricultural Land Act, Act 70 of 1970, as amended, is an important instrument in preventing agricultural land from being cut up into units that are too small. The Subdivision Section of the Division of Soil Protection is responsible for the administration of the Act.

The activities of the section amount principally to the handling of applications for the following: the subdivision of agricultural land, the vesting of undivided shares, township foundation, incorporation into areas of jurisdiction of municipal or similar bodies, long-term deeds of lease on portions of agricultural land and the registration of servitudes.

The numbers of applications received, dealt with and either granted or rejected are shown in Tables 3 and 4, and Table 5 deals with agricultural land only.

Number of applications dealt with in terms of the Subdivision of Agricultural Land Act, Act 70 of 1970

TABLE 3 - Applications for subdivision, vesting of undivided shares, township foundation and incorporation into areas of jurisdiction of municipal and similar bodies

Period	Approvals		Rejections		Total
	Num-ber	%	Num-ber	%	
1971-01-02 to 1978-06-30	5 245	75	1 733	25	6 978
1978-07-01 to 1979-06-30	585	81	137	19	463
1979-07-01 to 1980-06-31	377	81	86	19	722
Total	6 207	76	1 956	24	8 163

During the year under review, which covers a period of nine months only, 463 applications were dealt with, which is a *pro rata* drop of 15 % in comparison with figures for the previous year. This decrease is probably due to the slackness in the economy. Of the 463 applications, 377 (81 %) were approved and 86 (19 %) were rejected. This percentage is the same as for the previous year.

TABLE 4 - Applications in respect of leases and servitudes

Period	Approvals		Rejections		Total
	Num-ber	%	Num-ber	%	
1971-01-02 to 1978-06-30	394	96	18	4	412
1978-07-01 to 1979-06-30	62	97	2	3	64
1979-07-01 to 1980-03-31	68	97	2	3	70
Total	524	96	22	4	546

Seventy applications for leases and servitudes were received for the nine-month period of the year under review, which is more than for the previous year, which covered a period of 12 months.

TABLE 5 - Subdivisions for agricultural purposes

Period	Approvals		Rejections		Total
	Num-ber	%	Num-ber	%	
1971-01-02 to 1978-06-30	4 241	81	974	19	5 215
1978-07-01 to 1979-06-30	495	81	98	19	593
1979-07-01 to 1980-06-31	313	82	67	18	380
Total	5 049	82	1 139	18	6 188

During the year under review, which covered a period of nine months, only 380 applications were received, as against 593 the previous year (12 months). This is a *pro rata* decrease of 15 %. It has been noted, however, that the percentage of approvals has increased from 81 % to 82 %, which indicates that the standard of the applications received is more in line with the requirements of the Department than it was in the past.

Permission to subdivide agricultural land inevitably means an increase in the number of farms. On the other hand every effort is being made to consolidate smaller farms in order to turn them into more viable units.

The situation to date, arising from the application of Act 70 of 1970, is reflected in Table 3.

TABLE 6 - Number of farm units created and number of farms and areas of farms consolidated with other properties

Period	New farm	Consolidations	
	units created	Number of farms	Area (ha)
1971-01-02 to 1978-06-30	1 057	2 981	261 018
1978-07-01 to 1979-06-30	110	377	170 479
1979-07-01 to 1980-03-31	58	213	94 361
Total	1 225	3 571	1 525 858

During the year under review, which covered nine months, the number of new farm units created increased by only 58 as against the 110 of the previous year reviewed which, however, covered 12 months. This is a *pro rata* reduction of 30 % on the previous year.

The total number of new units created since 1971 is 1 225. However, during the year under review 213 small, unviable units disappeared as a result of consolidation. As many as 3 571 such small unviable units have disappeared since 1971.

Subdivision of agricultural land for non-agricultural purposes

In Table 7 the applications for subdivision for non-agricultural purposes are divided into two groups, namely:

- (i) Applications for extensive occupation, business purposes, resorts and mining operations, and



A gang of workers busy spraying nassella tussock. The photograph was taken in the Somerset East district

(ii) applications for intensive urban use.

During the year under review, which covered nine months, there were 117 applications for extensive occupation, business purposes, resorts and mining. This is 26 more than the 91 of the previous year, which covered 12 months. Eighty seven (74 %) of the 117 applications were rejected, as against 47 % the previous year. The area approved and the area rejected were, however, almost the same, namely 790 ha and 798 ha respectively.

With regard to intensive use, Table 7 indicates that 97 applications were received during the year under review (nine months) as against 48 the previous year (12 months). However, the area concerned is only 6 099 ha as against 54 867 ha the previous year. Of the total area of the Republic and SWA of 196 869 000 ha, a total of 180 044 ha, or almost 20 000 ha a year on average, has been relinquished for intensive occupation since 1971. The fact that there have been no rejections indicates that there is now more effective liaison beforehand between applicants and the Department and the province concerned.

Officers of this Division represent the Department on the Planning Advisory Council to the Prime Minister's Subsidiary Committee for the Disposal of State Land. Two inspections were

carried out during the year under review and one meeting was attended. Numerous inspections of agricultural land to be set aside for new roads, railways, defence purposes, Armscor, and nature conservation were undertaken.

During the year officers of the Division were frequently involved in discussions on proposed court cases arising from the sale of erven by township developers. Officers were summonsed 24 times during the past year to act as witnesses in court cases.

WEED CONTROL

Jointed cactus

The campaign against this declared weed is continuing. Notwithstanding the fact that about R11,34 million has been spent on spray since 1957, the infestations are not yet under control. On the contrary, the total area of all the farms infected with jointed cactus in the inspection area of the Eastern Cape and Karoo Regions increased by 2,1 per cent during the programme year just concluded. Existing infestations are still frequently traced. At present there are 1 717 applicants in the inspection area who have applied for spray or applied to participate in the control programmes. In addition

TABLE 7 - Subdivision for non-agricultural purposes: Number of applications and area involved

Period	(i) Extensive occupation, business, resorts and mining						(ii) Intensive urban use					
	Approved			Rejected			Approved			Rejected		
	Num- ber	%	ha	Num- ber	%	ha	Num- ber	%	ha	Num- ber	%	ha
1971-01-02 to 1978-06-30	633	50	23 124	634	50	41 630	482	93	119 078	36	7	6 083
1978-07-01 to 1979-06-30	52	57	752	39	43	1 369	48	100	54 867	0	0	0
1979-07-01 to 1980-03-31	30	26	790	87	74	798	97	100	6 099	0	0	0
Total	715	48	24 666	760	52	43 797	627	95	180 044	36	5	6 083

to the above inspection area, jointed cactus is spreading to an alarming extent in other areas as well, such as in Natal. On the other hand, it is found that the degree of infestation has generally been reduced from heavy infestation to medium or even light infestation.

Research: Good progress is being made in the field of weed control. It is intended to replace the present spray (Picloram in power paraffin) with a water-soluble insecticide in the near future. The biological control of jointed cactus is still being continued by the weeds laboratory at Uitenhage.

Nassella tussock

The Eastern Cape, Karoo and Winter Rainfall Regions are engaged in a fierce struggle to eradicate this weed. In the former two Regions, in particular, the infested areas are becoming very extensive. It is estimated, for instance, that there are medium to heavy infestations on 4 400 ha in the Karoo Region, and sporadic to light infestations on 30 500 ha. In the latter area farmers have sprayed or chopped down about 1 935 ha to date. In the area with medium to heavy infestations there are two State teams in the Karoo consisting of 88 labourers who have sprayed or chopped down 950 ha during the past year. In the Eastern Cape

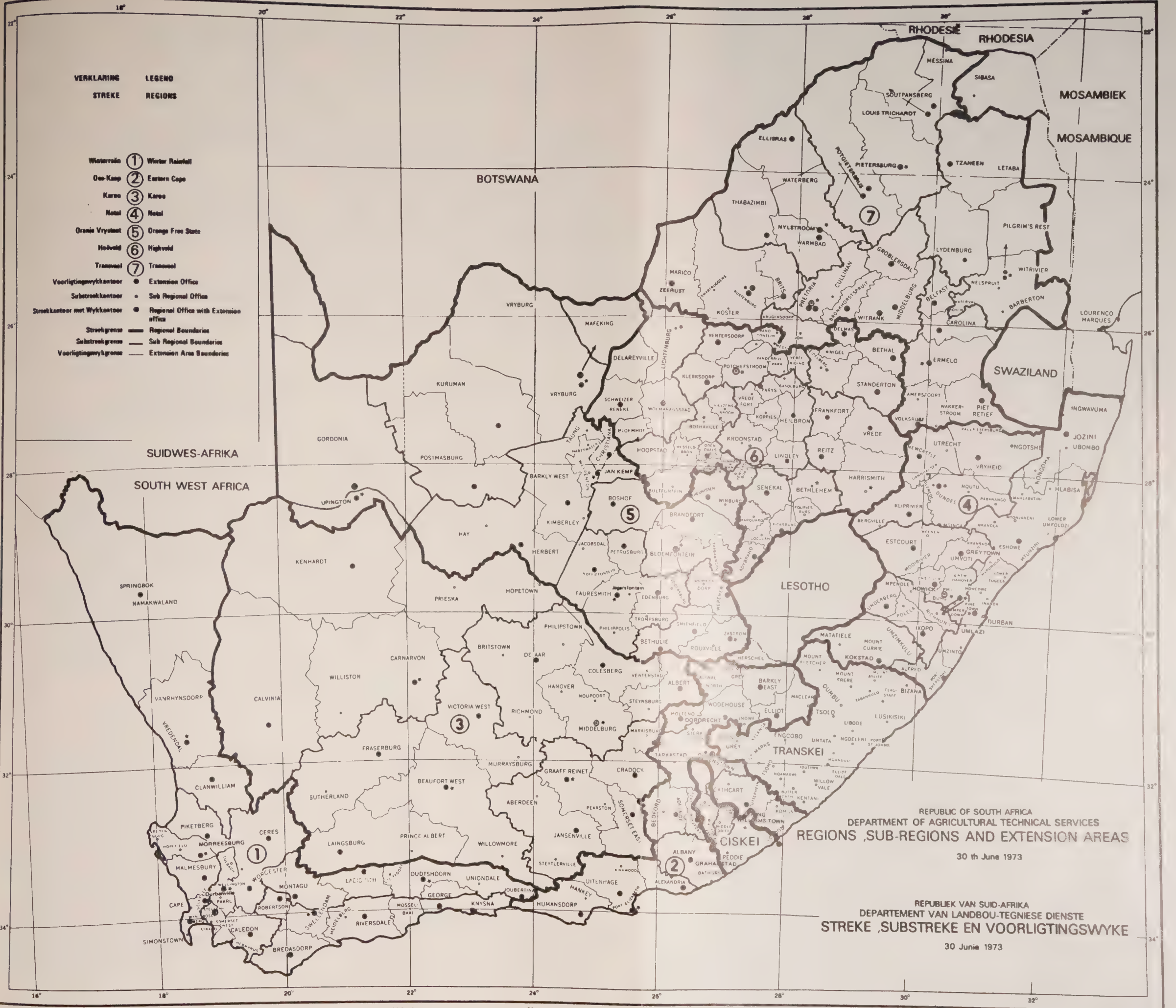
Region there are also two State teams, consisting of 90 labourers, who carried out control operations on seven farms during the past year. A total of 797 ha was sprayed or cut down in this Region. Work is in progress on guidelines on methods of eradicating this weed, and on the management and utilisation of reclaimed areas.

Additional plants declared weeds

Chromolaena odorata (L), also known as "paraffienbos" or paraffin weed, king's weed, trifid weed or lusikisiki was declared a weed throughout the Province of Natal during the year under review.

Concluding remark

The Division of Soil Protection is very concerned about the lack of progress with the weed control programmes in the Republic. The reasons may be the general financial position of the farmer and the lack of a positive attitude towards weed control. Another extremely important reason is the lack of well-trained and experienced weeds officers. It is intended to launch a nation-wide publicity campaign on the importance of weed control shortly. The aim is to make use of all available news media.



VERKLARING LEGEND
STREKE REGIONS

- Winterrain ① Winter Rainfall
- Oos-Kaap ② Eastern Cape
- Karoo ③ Karoo
- Metol ④ Metol
- Orange Vrystaat ⑤ Orange Free State
- Hoëveld ⑥ Hoëveld
- Transvaal ⑦ Transvaal
- Voortligtingsoffis • Extension Office
- Substreekkantoor • Sub Regional Office
- Streekkantoor met Wylkantoor • Regional Office with Extension office
- Streekgrense — Regional Boundaries
- Substreekgrense — Sub Regional Boundaries
- Voortligtingsoffis — Extension Area Boundaries

REPUBLIC OF SOUTH AFRICA
DEPARTMENT OF AGRICULTURAL TECHNICAL SERVICES
REGIONS, SUB-REGIONS AND EXTENSION AREAS

30 th June 1973

REPUBLIEK VAN SUID-AFRIKA
DEPARTEMENT VAN LANDBOU-TEGNIËSE DIENSTE
STREKE, SUBSTREKE EN VOORTLIGTINGSWYKE

30 Junie 1973

V. Entrepreneur Development

AGRICULTURAL EXTENSION SERVICES

The regional organisations of the Department are responsible for entrepreneur development, the object of which is the development of agriculture in general, and for optimum resource utilisation.

This task is performed by the extension staff of the regional organisations, employing means such as the mass media and personal contacts with producers; special emphasis is placed on group activities.

GROUP ACTIVITIES

Table 1 contains a summary of the group activities in which producers are involved by the extension staff of the seven regional organisations in the Department.

It is encouraging to note that study group activities and courses offered for farmers generally link up with particular programmes. If the total number of lectures delivered is taken as a criterion, it would appear that extension staff are more actively involved in group activities that form part of a programme (774 lectures) than in separate group activities (481 lectures). Although the total number of contacts with producers is less with programmes than with separate group activities, the quality of such contacts is probably better. Where group activities are programmed it may also be assumed that the learning situations are being more intensively utilised and that the material is more programme and need directed.

TABLE 1 - Group activities in which agricultural producers are involved by the extension staff of the seven regional organisations, 1979/80

Activity	Number		Total attendance figure or number of participants		Number of lectures delivered by extension staff	
	*P	*A	*P	*A	*P	*A
(a) Farmers' days held	90	173	3 613	7 638	113	115
(b) Courses presented for farmers	53	46	925	1 049	251	92
(c) Demonstrations held	69	74	877	1 225	37	61
(d) Study group meetings	412	277	3 524	2 706	242	68
(e) Soil conservation committee meetings	216	342	1 401	2 140	93	83
(f) Exhibitions held by extension staff	8	9	300	1 635	-	2
(g) Farming competitions held	36	29	160	207	-	-
(h) Meetings arranged with regard to (g)	8	22	288	388	1	18
(i) Co-operative trials/demonstrations	76	53	22	63	-	-
(j) Meetings arranged with regard to (i)	37	32	356	636	16	37
(k) Practical studies (yield standards and production techniques)	32	11	85	104	-	3
(l) Meetings arranged with regard to (k)	27	2	386	69	21	2
TOTAL	-	-	11 937	17 860	774	481

* P = activities that appeared on the work calendar of an extension programme

* A = *ad hoc* activities that did not form part of the work calendar of a programme

Table 2 shows the number of programme planning committees and study groups per subject.

As may be seen from Table 2, 263 study groups with a total membership of 3 041 are functioning at present and economic aspects, field crops and pastures are the most important subjects.

The utilisation of programme planning committees in purposeful extension work appears to be starting to gain momentum, despite the fact that the number of soil conservation committees functioning as programme planning committees has decreased since the previous year. The decrease in programme activities of soil conservation committees is probably related to the uncertainty about their future and the work that will be assigned to them in future.

EXTENSION PROGRAMMES

The object of the Department is to promote optimum resource utilisation, and the extension programme is an important instrument in attaining this object.

Table 3 gives particulars of certain programme activities of the extension service. An effort is being made to reach about 13 000 farmers in one way or another, although in some cases the extension service cannot do all it would like to, owing to the limited manpower available. The effectiveness of a programme should, however, be measured not by the extent of the inputs but by the results. The scientific evaluation of programme activities and results will necessarily have to play a more important part in future. A few successes will be briefly described by way of example.

Notable results were achieved during the past year with a programme launched in the Fish River

TABLE 2 - The activities of programme planning committees and study groups

Subject	Study groups per subject			Soil conservation committees acting as programme planning committees		Other programme planning committees	
	Number of active study groups	Total number of members	Number of active study groups functioning as programme planning committees	Number	Number of members	Number of other programme planning committees	Number of members
Pastures	26	328	1	22	149	-	-
Beef cattle	8	113	-	1	4	1	4
Dairy cattle	6	42	-	1	4	1	4
Sheep	2	20	1	4	31	-	-
Other livestock	4	47	-	-	-	-	-
Soil	5	127	3	-	-	-	-
Irrigation	3	22	-	4	40	-	-
Horticulture	12	156	-	-	-	-	-
Agronomy	65	970	3	17	126	4	27
Economics	104	874	1	1	8	-	-
Soil conservation	12	132	-	76	565	1	8
Other	16	210	-	8	40	7	42
TOTAL	263	3 041	9	134	967	14	85

Valley with the object of promoting wheat production. The total production of durum wheat in the area was boosted by 42 %.

A programme aimed at improving the fruit size of pomes was very successfully carried out at **Ceres**. The programme was launched over a period of four years and the percentage of undesirably small fruit was very sharply reduced - from 44,7 % to 23,4 % in Golden Delicious apples and from 35,4 % to 21,7 % in Buerre Hardy pears.

The **Worcester** study group increased their average annual net farm income from R15 111 to R40 377 during the past three years, and the average crop of winegrapes was raised from 13,25 to 16,48 tons per ha.

A programme for the control of nassella tussock in the **Swellendam** district resulted during the past year in an infested area of 183 ha on 15 farms being eradicated before the seed was able to spread.

In the **Natal Region** a land use survey known as Agriquest was started during 1979/80 and was

very successful. A total of 9 159 questionnaires with maps were returned (82 %). This information - and other data - is now being processed by a computer according to a grid reference system and particulars of the land use pattern in each bioclimatic region of Natal are being described in this way.

In the **Transvaal Region** there are 17 agricultural development programmes in progress at present and a total of 1 272 farmers are involved.

In the **Highveld Region** larger numbers of farmers have become involved in programmes during the year under review. Farmers are drawn into extension programmes chiefly through study group activities within fairly homogeneous extension areas; special efforts are made to involve the middle group of farmers. The approach adopted is to give the farmer a knowledge of the resources so that he can achieve optimum resource utilisation independently.

In the **Free State Region** the programme started in the Egmont subcatchment has made good progress during the past year. Up to 45 % of the

TABLE 3 - Scope of extension programmes

	*Programmes within fairly homogeneous areas		**Programmes directed at target audiences	
Number of programmes		49		62
Area involved (ha)		6 232 897		2 420 100
Number of farmers involved		7 963		5 022
Area of land or veld mapped during the year under review (ha)	<i>Land</i>	78 973	<i>Land</i>	2 215
	<i>Veld</i>	4 970		
Works surveyed during the year under review)				
(i) Waterways (ha)		774		163
(ii) Contours (km)		1 040		3 020
(iii) Other erosion works (number)		67		41
(iv) Stock-watering points (number)		164		151
(v) Other (number)		1		77

* For the purposes of this report "fairly homogeneous areas" refers to target areas, priority areas and development areas which are fairly homogeneous and for which development or run-off control plans are being drawn up and carried out.

** A target audience, for the purposes of this report, is a specific group of farmers or a community to whom a particular message of common interest is directed but who do not live in a particular fairly homogeneous area (e.g. dairy, pig or chicken farmers in a district/districts).

proposed camp fences and 60% of the proposed erosion fences have already been constructed.

In the **Eastern Cape Region** good progress has been made with a number of extension programmes during the past year. A very successful fuel-saving campaign was launched on a national basis this year and various interested bodies were involved. This again served to emphasise the importance of the extension service in times of crisis.

In the Transvaal, Highveld and Karoo Regions good progress was made during the past year with the demarcation of fairly homogeneous farming areas.

FARMING TRENDS

TRANSVAAL REGION

The agricultural extension service of the Transvaal Region has had to take note during the past year of a number of important changes in trends in agriculture that affect the extension effort directly. The marked decrease in tobacco cultivation is continuing as a result of the quota system and the chlorine problems in certain areas. There are indications that the switch from flood to sprinkler irrigation is continuing and that mechanised irrigation is gaining ground. There has also been a discernible shift from industrial milk production to fresh milk production, and wheat production on the Springbok Flats is decreasing sharply in favour of the production of other summer crops.

A further trend in the Lowveld is that larger areas are being planted to permanent crops, such as citrus, banana, avocados, coffee etc. and that the area under vegetables is decreasing accordingly. Furthermore, farm planning is slowing down and considerably less subsidy funds are being paid out as a result of the less favourable subsidies on certain items, particularly fences and stock-watering points.

EASTERN CAPE REGION

In the Adelaide, Fort Beaufort and East London districts farmers are running larger numbers of Boer goats in order to make better use of shrubs and scrub, and a switch to Angora goat farming is taking place at Stutterheim and Uitenhage. At Stutterheim the area of land under cultivation is tending to decrease, and in Dordrecht and Indwe the cultivation of perennial forage crops is rapidly gaining ground. In the Aliwal North and Dordrecht wards farmers are expanding their dairy herds and at Alexandria they are changing from chicory production to the production of wheat and artificial pastures.

HIGHVELD REGION

Owing to the high fuel costs farmers are investigating various methods of cultivation.

Minimum soil cultivation has been tested on a limited scale.

Low-potential soils are increasingly being withdrawn from cash crop cultivation and put under forage and perennial pasture crops.

The area under grain sorghum and sunflowers is still increasing. This may be ascribed to the fact that these crops do better on low-potential soils than crops such as maize.

Farmers are tending more and more to adjust their fertilizing programmes according to soil potential. There has also been a visible increase in the use of nitrogen fertilisers.

WINTER RAINFALL REGION

Boland Subregion

- In the Paarl area there has been a disturbing increase in the planting of table grapes, probably as a result of the very high export prices. In the Hex River Valley a number of traditional table grape farmers have again risked planting plums, which are a highly profitable crop at present, but which are thought likely to oversupply the limited market.
- At Ceres there has been a marked switch from red to green apples, probably because of higher yields and prices. There is also a tendency among pome farmers to space their trees more closely and attempts are being made to bring the trees into bearing earlier by means of manipulation. However, this tendency seldom takes growth potential into account and the trees are frequently so dwarfed by the heavy crop that the space allowed them is never utilised.
- Alternative forms of fruit preservation, such as drying and juice extraction, represent a healthy trend and one that is gaining ground rapidly.

Swartland Subregion

- The adjustment in the producer price of wheat has resulted in some grain farmers expanding their wheat enterprise at the expense of sheep.
- In the Piketberg Ward farmers are expanding their dairy herds for the production of industrial milk, and mechanisation of the milking process is also increasing.
- Interest in tobacco cultivation is decreasing as a result of several factors, such as high production costs, the current overproduction of tobacco and the enormous increase in kromnek virus infection, which does a great deal of damage.
- The interest in the planting of rooibos tea and the renewal in the industry are continuing.

South Coast Subregion

- Farmers are clearly making more responsible use of fuel and fertiliser.

- More soil analyses are being carried out, and the practice of fertilising on the basis of the true needs of the crop and the potential of the soil is gaining ground.
- The practice of choosing crops on the basis of soil potential is becoming more generally accepted.
- Interest in the herd competitions is increasing.
- Good crops and better prices for sheep, wool and meat have enabled many farmers to reduce or discharge debts they have been carrying for years.

Little Karoo Subregion

- Whereas the traditional system was to allow ostriches to graze lucerne pastures, farmers are now tending increasingly to remove feed from fields and feed it in the form of freshly cut or dry rations. This practice is the result of local research, which has shown that more effective feed utilisation can be obtained in this way.
- In the Ladismith Ward the production of dried fruit is still showing a rising trend and considerably more fresh fruit is being packed for the local market, at the expense of the canning industry. There also appears to be renewed interest in the local table grape market.

NATAL REGION

- Intensification and the horizontal expansion of maize production are still taking place in the maize areas of the Natal Region. In the Greytown district the production of hybrid seed is increasing, at the expense of commercial maize production.
- Minimum soil cultivation is becoming increasingly popular among maize farmers as a result of the high fuel costs.
- The less favourable economic position of beef farmers in Natal is causing a continuous switch to industrial milk production.
- Owing to the unfavourable vegetable prices of the past three seasons, there is a trend among farmers in the Umlaas catchment of the Natal Midlands to stabilise their farms by introducing the animal factor.
- The good cotton yields of the previous seasons have resulted in an increase in plantings in the Estcourt area of the Natal Midlands, both under irrigation and on dry land.
- Cauliflower and cabbage plantings on farms bordering Transkei have increased owing to the big demand for these products in the Transkei.
- Coffee plantings are increasing on the Natal South Coast and there are already 12 commercial plantations of an average size of 5 ha each.
- The area under bananas on the South Coast of Natal is still expanding gradually.

FREE STATE REGION

- Beef farmers are switching from weaner calf to steer and ox production.
- Dairy farming has increased in the crop farming and mixed farming areas.
- There has been a reduction in beef cattle numbers in areas where sheep are an important enterprise.
- The planting of perennial forage crops, such as dryland lucerne, in the mixed farming areas is increasing.
- The application of the long fallow rotational cropping system with summer and winter crops is gaining ground.
- Wheat cultivation is expanding at the expense of maize cultivation.
- Grape farming is expanding in the Lower Orange River irrigation area. Greater interest is being shown in the cultivation of wheat, maize and cotton in this area, mainly at the expense of lucerne.
- More cotton is expected to be grown in the Vaalharts irrigation area as a result of the occurrence of pod rot of groundnuts there.
- The establishment of a dehydration plant at Vaalharts is expected to stimulate vegetable growing.

KAROO REGION

It is evident that farm units are tending to become larger, but units that are too small remain one of the biggest stumbling blocks in the way of optimum resource utilisation in the Karoo. Most of the owners on uneconomic farm units are finding it increasingly difficult to recover after the droughts. These farmers have the choice of either reducing their livestock numbers to the point where they are no longer able to meet their financial commitments or maintaining their stocking rate throughout the drought, with the consequent destruction of their veld.

PROBLEMS FACING AGRICULTURAL PRODUCTION

EASTERN CAPE

Nematode infestation in chicory, the problem of wintering livestock, especially in the sourveld areas, inadequate mechanisation planning, high fuel costs and lack of motivation among farmers in applying the farm plans that have been drawn up are all problems that merit urgent attention.

HIGHVELD REGION

The virtual lack of any judicious pasture management measures is a cause for concern.

TABLE 4 - Student numbers at colleges of agriculture in the Republic during 1978/79 and 1979/80

	Student numbers			
	Juniors		Seniors	
	1979/80	1978/79	1979/80	1978/79
Number of students	365	335	276	294
Number resident	339	305	247	268
Number non-resident	26	30	29	26
Number of passes	-	269	-	282
Number of failures or discontinuations	-	66	-	12
Number:				
Afrikaans-speaking	237	221	186	197
English-speaking	128	110	89	94
Foreign	-	4	1	3

TABLE 5 - Short courses for farmers presented at colleges of agriculture in the Republic, 1979/80

Subject	Number of courses	Number of attendants
Sheep and wool, angora goats and mohair and wool classing	19	489
Dairy farming and dairying	9	476
Beef farming	3	291
Artificial insemination	22	289
Farming business management, systems analysis	3	43
Mechanisation	1	8
Grazing, feed planning	2	26
Grain production, dry beans	6	217
Other	1	38
Total	66	1 877

NATAL REGION

- The enormous increase in the fuel prices and the higher fertiliser and mechanisation costs, together with the severe drought of the past year, have dealt many farmers in Natal a serious blow.
- Greater attention should be given to financial planning.
- More research and extension are required in respect of vegetable and subtropical fruit growing in the coastal areas of Natal.
- The condition of the grazing in the pasture areas of Natal is a cause for serious concern.
- Production planning for dairy farms should receive attention.
- Strip cultivation of sloping sugar-cane fields is urgently required to prevent erosion losses.

FREE STATE REGION

- Pod rot of groundnuts requires attention.
- Irrigation scheduling and the planning of irrigated soils are urgently required.
- A lack of interest among farmers in group activities is a cause for concern.

KAROO REGION

During the year under review the Karoo Region experienced one of its driest periods in living memory, especially in the western areas. The

last effective rains in these parts fell as far back as April 1977. The drought has therefore lasted three years, with rainfall figures 66 %, 32 % and 47 % below normal for the three years, respectively.

During November 1978 the first magisterial districts were scheduled as grazing distress areas. At the beginning of 1979 about 18 million ha of grazing in the North-Western Karoo and Great Karoo Subregions were scheduled. This is about 62 % of the area of the Region.

Although no magisterial districts in the other two subregions have been scheduled as grazing distress areas so far, the rainfall was below normal and conditions were critical.

TRANSVAAL REGION

An important problem facing agricultural development in the Transvaal Region is the fact that farmers' choice of crops, fertilisers and irrigation are not adapted to the soil potential.

Because of a very serious shortage of agricultural extension officers and a lack of adequate extension research, however, these problems are not receiving the attention they merit.

TRAINING AT COLLEGES OF AGRICULTURE

The Department is responsible for the training of prospective farmers at colleges of

agriculture. There are five colleges, namely those at Cedara (Natal), Elsenburg (Stellenbosch), Grootfontein (Middelburg, C.P.), Glen (Bloemfontein) and Potchefstroom (Transvaal).

Table 4 gives particulars of student numbers at colleges of agriculture in the Republic for the year under review and the previous year.

Short courses

The college of agriculture plays a valuable part as an information centre for farmers in the area served. The scope of the short courses for farmers presented at colleges of agriculture during the year under review is reflected in Table 5.

AGRICULTURAL INFORMATION SERVICES

POPULAR PUBLICATIONS

During the year under review 302 leaflets were prepared and printed. A total of 2,94 million copies was printed in both Afrikaans and English. Reprints of existing leaflets came to 198 000 representing 87 titles. The leaflets are distributed according to a mailing list which contained 62 991 names at the end of the year under review.

A total of 66 900 various inland newsletters was printed. Two new newsletters appeared for the first time during the year under review - those of the Highveld Region and the Tobacco Research Institute.

122 000 copies of the Department's own newsletter, *Agricultural News*, were printed.

In all 27 000 *Agricultural Reports* were printed, 91 200 lectures, library lists and manuals, and 36 300 test results and milk records.

Regular publications such as *A Guide to the Use of Pesticides and Fungicides*, *Agricultural Research*, *Agricultural Review* and the Department's annual report were again prepared and published during the year under review. For the Department of Agricultural Economics and Marketing an annual report, one edition of *Trends in the Agricultural Sector* and three editions of *Agrekon* were prepared for printing.

SCIENTIFIC PUBLICATIONS

Agroplantae, Agroanimalia, Agrochemophysics, Phytophylactica

During the period under review, 84 articles were received, one article more than the previous year. With a carry-over of 68 articles from the previous year, 151 articles were therefore dealt with. Sixty-five of these were approved, 70 are still being considered, four were rejected, one withdrawn and one was combined with another article.

On the recommendation of the Committee appointed to investigate the continuation of these journals, the Department decided to suspend

publication of these four journals in due course and to channel the scientific articles of its research workers to identified South African journals.

Publication of a journal will not cease before the discipline society(ies) journal(s) which cover the field of the departmental journal concerned, meet the requirements of a scientific journal. The Department still expects its researchers to give full support to the departmental journals until such time as they cease publication.

Onderstepoort Journal of Veterinary Research

Three editions - Volume 46(3), 46(4) and 47(1) appeared during the year under review.

During this period 29 contributions were received and 28 were published.

Other scientific publications

Other scientific publications which appear are the following: *Botanical Survey Memoir*, No. 44; *Entomology Memoir* No. 51 and 52; *Technical Communication* No. 157, 158, 159, 160, 161, 162, 163, 164, 165 and 166.

AGRICULTURAL NEWS

The value of *Agricultural News* as an important news medium for the outside world again became abundantly clear during the past year. The rural press and weekly agricultural journals made increasing use of reports appearing in the newsletter.

Research workers, extension officers and other officers as well as officers of private agricultural companies increasingly consult the newsletter as a source of information.

The editorial staff concentrates on the contents, typography and lay-out of the newsletter to maintain its standard at the highest level.

Reports on virtually all activities and achievements of the Department of Agriculture and Fisheries were collected and published.

RADIO SECTION

The programmes of the past year convey a picture of increasing specialization in many sections of agriculture. They also indicate the many challenges the modern farmer has to face.

The significance of the part played by the mass media such as radio, continues to grow to satisfy the rising demand for relevant and up-to-date information.

Leading farmers shared their experience in the growing of wine and table grapes, drought-resistant fodder crops, coffee, cotton, bananas, pineapples, sisal, macadamias and in the cultivation of certain plants for essential oils. Several explained the fuel saving measures they have adopted to meet their particular circumstances and some specifically gave guidance to young farmers coming into their region or bioclimatic zone for the first time.

At Ministerial level, the former Minister of Agriculture and Fisheries, Mr Hendrik Schoeman, broadcast on various occasions on matters

REPUBLIEK VAN SUID-AFRIKA
REPUBLIC OF SOUTH AFRICA

LANDBOONAVORSING
AGRICULTURAL RESEARCH

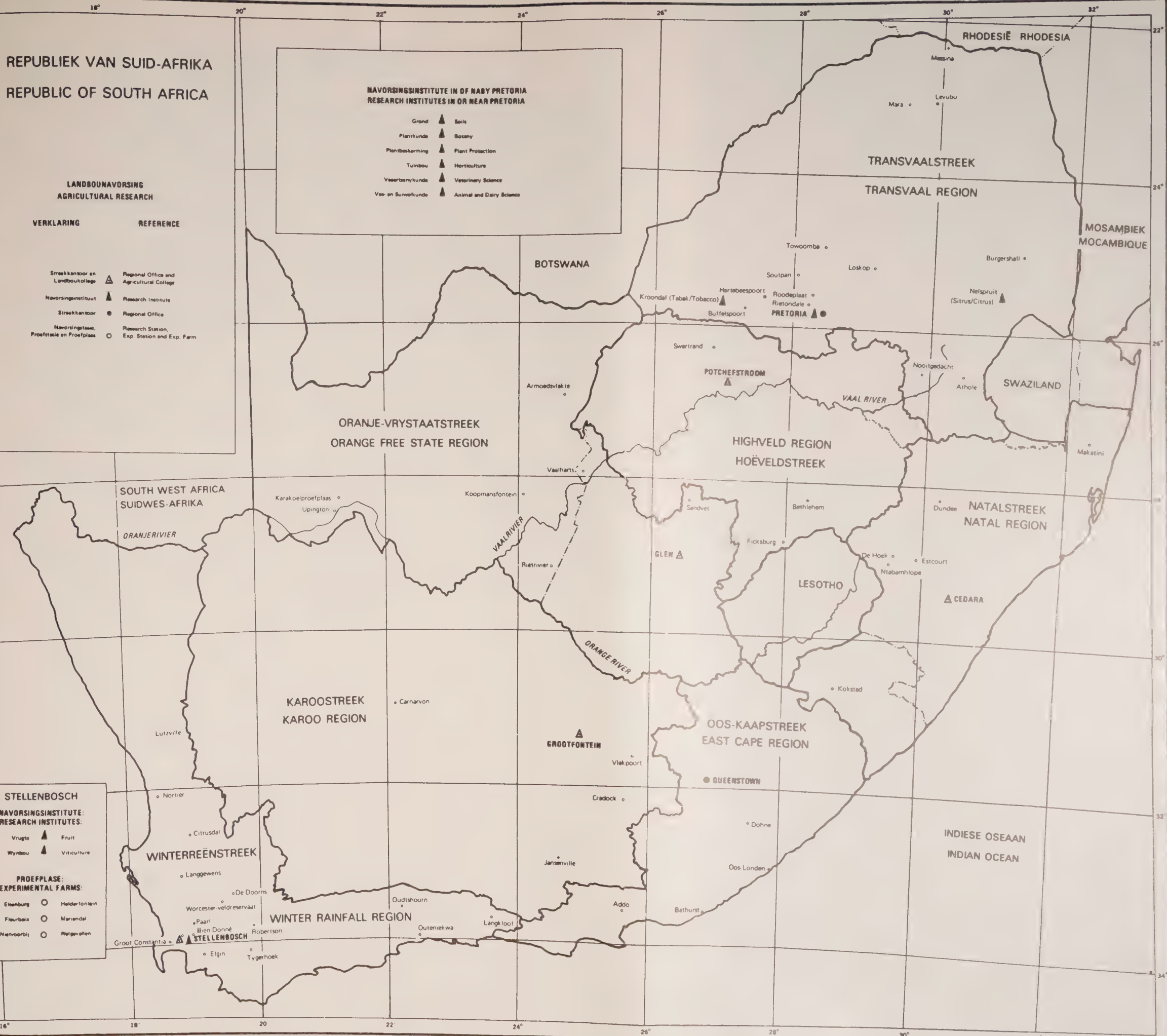
VERKLARING

REFERENCE

- Streekkantoor en Landboukollege
Navorsingsinstituut
Streekkantoor
Navorsingstaas, Proefstasie en Proefplaas
- Regional Office and Agricultural College
Research Institute
Regional Office
Research Station, Exp. Station and Exp. Farm

NAVORSINGSINSTITUUT IN OF NABY PRETORIA
RESEARCH INSTITUTES IN OR NEAR PRETORIA

- Grond
Plantkunde
Plantbeskerming
Tuinbou
Veerteekniese
Vee- en Suivelkunde
- Soils
Botany
Plant Protection
Horticulture
Veterinary Science
Animal and Dairy Science



STELLENBOSCH

NAVORSINGSINSTITUUT:
RESEARCH INSTITUTES:

- Vrugte
Wynbou
- Fruit
Viticulture

PROEFPLAAS:
EXPERIMENTAL FARMS:

- Elzenburg
Flourbaai
Nervoorbi
- Heiderfontein
Marandai
Wageningen

concerning important agricultural issues. The Deputy Minister, Mr Sarel Hayward, enlarged on the government schemes to encourage the stabilization of farming in the border areas.

Scientists from the Department of Agriculture and Fisheries gave practical advice on such diverse subjects as the use of pastures and legumes for economic animal production, flexi-pipe irrigation, the keeping quality of potatoes, orchard pruning and thinning, plant breeders' rights, waste disposal and financial management, to name but a few.

In addition, officials from other government departments, semi-government bodies and private consultants gave listeners the benefit of their expertise on matters of particular pertinence to the modern farmer, including manpower management, economic implications of the Atlantis tractor engine programme, the depopulation of the rural and border areas, the work of the Livestock Welfare Co-ordinating Committee, heart disease and diet.

AUDIO-VISUAL SERVICES

Eighteen new slide series were made on the request and with the co-operation of agricultural extension officers and several research institutes. Each program was supplied with commentary in both official languages on a sound cassette and in printed form.

There are duplicates of 120 different slide programs in stock. During the year under review 178 programs were lent out and 113 issued permanently to extension offices and other institutions.

Several non-departmental institutions such as universities also purchased programs for training purposes.

The 18 new programs include five series that were compiled for the fuel saving campaign.

CENTRAL AGRICULTURAL LIBRARY

As a result of the rationalisation of the Public Service the new Department of Agriculture and Fisheries' libraries were increased by two, viz that of the former Department of Agricultural Economics and Marketing and the Division of Sea Fisheries of the former Department of Industries. Hereby twenty branch libraries are now under the control of the Central Agricultural Library.

The creation of a *South African Documentation Centre for Agricultural Information* (SADAL) was approved by Treasury. The Documentation Centre will be managed by the Division of Agricultural Information while the Central Agricultural Library will be responsible for retrieving information from the system. To start with, it is our aim to obtain magnetic tapes of the *Commonwealth Agricultural Bureaux's* complete information bank etc. for local use.

A video display unit will be installed in the Central Agricultural Library so that on-line literature searches can be done for officials. At the different Divisions, Regions and Institutes liaison officers will be nominated to interpret the needs of officials for the Documentation Centre.

A further component of the Documentation Centre that is being considered is the inclusion of current research projects on magnetic tapes.

Because of the Central Agricultural Library's change in loan policy the public are no longer allowed to borrow directly from the stock, but under the inter-library loan system. More emphasis can now be placed on the service to the researchers of the Department. All the branch libraries were visited during the past year and generally few problems were experienced.

VI. Supporting Services

BOTANICAL RESEARCH

The need for botanical research to supply answers to problems in connection with the management, optimum utilisation and conservation of the plants and vegetal cover of Southern Africa is becoming more evident as environmental problems increase. For this reason it has proved necessary to allocate more manpower to taxonomic and ecological research.

In the field of ecology the priority areas were the fynbos of the winter rainfall area of the Cape and the coastal aquatic and adjacent terrestrial habitats. The difficult field of root growth research yielded some interesting results, but a great deal more work will be required. More research on ecophysiology and the dynamics of vegetation has become essential for progress.

The venture by the Department into palaeobotanical research, even though a new departure, is a natural extension of the series of botanical inventories for different plant groups represented by the *Flora of Southern Africa*.

A highlight of the year was the declaration of the Pretoria Botanic Garden as a national monument, an indication that it is recognised as a valuable asset as well as an indispensable part of the research organisation of the Department.

FLORA RESEARCH

Flora of Southern Africa

Vol. 10, Part 1, on Loranthaceae and Viscaceae, and Vol. 27, Part IV, on the general *Brachystelma*, *Ceropegia* and *Riocreuxia* were published. Work on other volumes is proceeding.

Pretoria flora

Texts of 195 species (including the family Fabaceae) were prepared for the printer. Material of a further 120 species was prepared for typing, and texts of 291 species were re-written and are almost ready for typing.

Palaeoflora of Southern Africa

A revision of the genus *Dicroidium* (extinct seed ferns), including some 20 species, is being prepared as Volume I of the series on palaeoflora. The material is based on 45 localities spread throughout the Molteno Formation outcrop. The 50 photographic plates illustrating the reference populations have been prepared and the text is two-thirds completed.

A palaeobotanical herbarium has been established at the Institute and the fossil collections are now housed in 20 specially designed cabinets.

The collection comprises some 5 000 specimens to date.

Register of plant taxonomic projects

A new edition of this register listing more than 300 current projects on African plants was completed and distributed world-wide in microfiche form.

Botanical collectors in Southern Africa

The initial write-up is complete and Part II of the work (Dictionary of Botanical Collectors) is being prepared for publication. The text of Part I (Historical Introduction) is undergoing revision.

Southern African Plants

Text and illustrations for brochures on 20 of the most important water plants were sent to the printer.

Liaison Officer, Kew

This officer continued with research on the taxonomy of *Rubus*, *Lantana* and various genera of Fabaceae. In addition he checked on the nomenclature of the weeds included in the National Weed List and dealt with numerous queries from the Botanical Research Institute, universities and other institutions in the Republic.

PLANT STRUCTURE AND FUNCTION

Grass leaf anatomy

This project continued to yield interesting results in the genus *Merxmuellera* (= *Danthonia*), where the comparative anatomy of the summer rainfall species was completed. These studies have clearly shown that in the Drakensberg region there has been extensive diversification of this genus, with the basic *Merxmuellera stricta* and *M. disticha* lines showing parallel anatomical and ecological adaptations to the various habitats inhabited by these species in this area.

From the results of this study it appears that several taxonomic adjustments to the current classification of these *Merxmuellera* species are required.

PLANT EXPLORATION

The origin and evolution of *Sorghum*

One hundred and two collections of *Sorghum* have been made during field trips to Natal and the Northern and North-Eastern Transvaal. Thirty-two collections from elsewhere in Africa have been



Australian wattles, mainly silver wattle *Acacia dealbata* and black wattle *A. mearnsii*, which are encroaching on other tree species on the foothills and along stream banks near Loteni at the foot of the Natal Drakensberg range



A root observation chamber under construction. It is placed underground so as to observe the root growth of savannah plants



A cross section of the leaves of *Merxmüllera stricta* (top) and *M. disticha* (bottom). There is a clear anatomical distinction between these two basic species

obtained from the Department's seed bank and have been grown. Herbarium collections, seed (when available) and photographs have been taken to form the basis of a study of the origin and evolution of *Sorghum* in the sub-continent. Chromosome counts have been started.

The origin and evolution of *Pennisetum*

Ninety-two collections of *Pennisetum* were made in Natal and the Transvaal and seed of 25 collections from elsewhere in Africa was grown to provide material for a study of the origin and evolution of this group.

Conservation of germ plasm

Seventy-eight collections of *Sorghum* seed and 46 collections of *Pennisetum* seed were contributed to this project, which aims to conserve germ plasm of primitive varieties of crop plants. Other collections included 27 of *Citrullus* and related taxa, 6 of *Lagenaria* and 10 miscellaneous. Information relating to rare and endangered indigenous species was also gathered.

Ethnobotany

An investigation of wood utilisation by the Tsonga of Gazankulu has been commenced. Collections have been made in the study area to enable firewood and wood used for building to be identified by gross morphological features. The quantity and kinds of wood used for different purposes will be monitored over several seasons and the effect of timber gathering will be analysed.

Cover and barrier plants

A survey of indigenous plants with potential as barriers or ground covers has been initiated. Plants are being collected, grown and screened for use as hedges, binders, windbreaks, etc. in the various climatic regions of South Africa. Over 100 plants with potential have been identified and over 50 have been collected for propagation and screening.

Tree distribution in the Transvaal

Two hundred and ten field listings of woody plants have become available during the year under review. Most of these were provided by co-operating researchers from outside the Department, who helped fill distribution gaps in the Waterberg and in Venda. Of the approximately 7 000 1/16th degree squares occurring in the Transvaal, 1 900 have now been sampled. The field work is scheduled for completion next year.

Information service

Two hundred and sixty-one requests for information about economic plants and their utilisation or control were answered by our information service. These included about 120 identifications. Particular interest was shown in oil and rubber producing plants such as *Simmondsia*

(jojoba) and *Parthenium* (quayule). Over two thousand visitors, including delegates to the International Rose Convention, members of the Wild Life and Tree Societies and many scholars, were taken on tours of the Institute.

WEED RESEARCH

National Weed List

The first draft of the National Weed List, which contained the names of 700 species, has been expanded as a result of suggestions received from many correspondents. Approximately 1 500 species and 4 500 common names are now listed

The identities of exotic species have been checked at Kew and the listed species are now being classified according to whether they cause problems and the kind of problems caused.

Woody invaders

The intensive survey of exotic woody invaders in the Central Transvaal, which was completed last year, has been analysed and the minimum effective sampling level has been calculated. Sampling at this level is now being expanded to cover the rest of the Transvaal.

The rate of spread of some invader species has been calculated from aerial photographs. For example, one large infestation of *Acacia dealbata* (silver wattle) has increased its area by 20 % in eight years. This work is continuing.

Lantana camara

The voluminous international literature dealing with *Lantana* has been reviewed, herbarium material in Europe has been consulted and most of the nomenclatural problems of the *L. camara* complex have been sorted out.

Most of the cytogenetic work on the many variations occurring in South Africa has also been completed.

Nassella tussock

Research on the germination, establishment and distribution of the grass weed *Nassella tussock* in the winter rainfall area is continuing.

GOVERNMENT HERBARIA

Information

A total of 19 812 plant specimens were identified for officers of the Institute, various Government departments and provincial administrations, universities, the public and neighbouring states. The herbaria dealt with 2 026 visitors requiring information on a wide range of subjects.

Development

The collections of the four herbaria were increased by 23 161 specimens. These resulted from several local minor expeditions and from exchanges

received from local and overseas herbaria. A new cryptogamic wing was established to cover mosses and lichens.

Research

Taxonomic research by staff of the herbaria is continuing as a contribution towards *Flora of Southern Africa*. The groups covered are Bryales (masses), Ericaceae, Poaceae, Polygonaceae and Campanulaceae. A start has been made on the lichens.

BOTANIC GARDEN

During the year under review a number of new development projects were undertaken at the garden. Excavations for a marsh in the coastal forest biome were carried out. Hillocks were constructed in the Karoo and grassveld biome. Excavations for four dams were carried out in the general part of the garden. As a result of the time and labour required by these projects, no trees or other perennial plants were planted for the expansion of the scientific collection in the garden. During the year the garden was declared a national monument and a commemorative plaque was unveiled in the garden on 25 October 1979.

ECOLOGY

Transvaal bushveld studies

To complement earlier work on this programme a project to study the ecology of the Sour Bushveld (Veld Type 2)) has been initiated. This veld type is due to undergo greater intensification of agricultural and other uses, and rational planning for multiple-use management must be set in motion to reconcile intensification with sometimes conflicting, but valid needs such as nature conservation and recreation. Field work on this project started in 1980 and by the end of March 132 quadrats had been sampled.

Coastal studies

The seaward advancement of the dunes at Mtunzini, Natal, was studied by comparing aerial photographs taken from 1937 to 1977. Dunes advanced by an average of 95,2 m during this period, at an average rate of 2,4 m per year.

The vegetation of the Wilderness lakes in the Southern Cape and the water-plant encroachment problem were studied. An increase of emergent water plants and a decrease of submerged water plants were detected in localised areas. This is related to the lower water levels owing to the artificial opening of the Wilderness Lagoon, in addition to natural succession. A full report was prepared on the various systems and their management.

The floristic information gathered from 247 relevés is being processed by Braun-Blanquet phytosociological methods to identify plant communities of dry coastal ecosystems and to interpret their environmental relationships. The

communities of the rocky coasts are different from those of the dunes, but the dune vegetation appears to be more complex than was previously thought.

A reconnaissance of conservationworthy areas of fynbos in the Knysna-Wilderness-Plettenberg Bay Guide Plan Area was undertaken for the former Department of Environmental Planning and Energy to provide the basis for the protection of natural areas.

A report and map were produced recommending that 13 areas be identified as natural areas.

Cape fynbos studies

Vegetation survey of the Cape of Good Hope Nature Reserve

Field work for assessing the rate of infestation of plant invaders over a ten-year period was completed during the year. This entailed re-locating 27 permanent sample plots and re-enumerating the invader density on them.

A primary survey of the Rooiberg Mountain Catchment Reserve near Ladismith, Cape

The structural units and floristic associations identified during the survey closely correlate with one another and their distribution reflects the major environmental influences, aspect and altitude. It is concluded that, despite the preliminary character of the survey, resource inventories of this type are suitable as a foundation for park management.

A preliminary study of floristics has also been published in which it was shown that the Rooiberg flora has strong affinities with the eastern fynbos element and with the dry fynbos of the inland mountain ranges.

Physiognomic classification of mountain fynbos

The field work for the classification has been completed. Field work was carried out on 508 plots located on 20 transects on all mountain ranges of the Southern Cape. In each plot detailed information on structure and function (growth-form, height classes, etc.), environment and floristic composition (dominant species, etc.) was collected. All the structural-functional and environmental data have been edited, coded and placed on computer file ready for analysis. The dominant species are being identified and the floristic data coded.

A study of the vegetation along transects through the Western Cape foreland

The sampling of the natural vegetation along four transects through the Western Cape's coastal foreland was completed. Two hundred floristic and two hundred physiognomic relevés and 614 specimens were collected. All the data were coded for computer analysis.

The preliminary results from the analysis of the first transect indicate that all three of Acocks's veld types found in the area can be clearly

distinguished. A more detailed analysis is not possible until a larger percentage of the specimens collected have been identified.

***Orothamnus* project**

The annual monitoring of *Orothamnus zeyheri* ("marsh rose") populations in the Kogelberg State Forest was undertaken during January 1980. Phenological, growth-rate and population-size data were recorded. Two new populations were found.

The total number of plants counted compares favourably with the maximum population size previously known, if it is considered that between nine and twelve years have elapsed since regenerative treatments were originally applied and that *O. zeyheri* normally has a life-span of less than 23 years.

Aquatic ecology

Classification and mapping of aquatic macrophyte communities of Natal

The preliminary classification of the water-plant communities of Natal is completed and a paper is ready for publication. Water-plant communities are grouped into categories based on their habitat preference and tolerance of water salinity and its acidity or alkalinity. The categories are marine, estuarine, brackish water, moderately fresh to slightly brackish water, slow-flowing and fast-flowing fresh-water communities. The distribution of the communities, included within each category, is mapped and their composition and environmental tolerance are discussed.

An ecophysiological study of water hyacinth in Natal in Natal

Data collected on water hyacinth *Eichhornia crassipes* have been synthesised and the final report is being prepared. Grown constants determined in culture cannot be used to predict growth rates of plants in the field. Growth rates in the field are high, with an average mass doubling time of three days in eutrophic situations. Growth is highly correlated with radiation, temperature and relative humidity. The density of the water hyacinth populations influences the rate of growth and chemical composition of plants.

South African Savanna Ecosystem Project

Further work on savanna root growth, using a sophisticated root observation chamber, has yielded valuable results. The chamber incorporates a microscope and travelling carriage enabling precise observations of the activity of the subterranean plant component, which is important to the functioning of savanna vegetation as a whole.

Pioneering work on the effects of plant water status on the radial growth of South African bushveld trees has been carried out within the South African Savanna Ecosystem Project. Techniques have included the severing of tree trunks held in position while simultaneously

monitoring various properties of the tree trunk and leaves.

National Conservation Plan

The NAKOR National Plan for Nature Conservation project comprised mainly the handling, storage and mapping of data on conserved areas in South Africa and the establishment of a computer data bank. At present information on about 300 existing and 100 proposed conservation areas is stored. These data are available for retrieval and processing in various ways for planning purposes.

DATA PROCESSING

The herbarium data bank is now fully operational and is proving most useful. A small number of errors remain to be eliminated.

A number of other activities involving use of the computer, including Braun-Blanquet ecological surveys, modelling and data banking for the South African Savanna Ecosystem Project, indexing for bryophyte taxonomic studies and group-forming for taxonomy, were dealt with on a routine basis.

PUBLICATIONS

Since this report covers only nine months and two of the Institute's journals normally appear in the eleventh month, the total of scientific papers, 17, is considerably lower than usual.

One Memoir of the Botanical Survey of South Africa was published, namely No. 44, "A conspectus of the African *Acacia* species" by Dr J.H. Ross. Vol. 10, Part 1 (Loranthaceae and Viscaceae) and Vol. 27, Part 4 (*Brachystelma*, *Ceropegia* and *Riocreuxia*) of the *Flora of Southern Africa* appeared in print during the year under review.

PLANT PROTECTION RESEARCH

NATIONAL COLLECTION OF INSECTS

Specialised taxonomic studies

Parasitic Hymenoptera

The collections of the Encyrtidae and Aphelinidae, the two families that are receiving the most attention, are still expanding. Accessions of which the host and host plants are known now amount to 6200. Accessions were further expanded by a number of specimens of exotic species received from collaborators in England and Russia.

The building up of the collection of other parasitic wasp families is still receiving attention and about 17000 specimens have already been collected by means of collecting nets, suction traps and Malaise traps; about 10000 of these specimens have already been pinned up. Accessions for which biological data are known now amount to 340.

Several identifications of parasitic wasps associated with pest insects in biological control programmes have been carried out. During the past year such identifications were undertaken for researchers in the Republic, Zimbabwe, Réunion, Senegal and the U.S.A.

Three taxonomic studies were completed and submitted for publication. Two of these articles deal, respectively, with the genera *Psyllaephagus* (parasites of psyllids) and *Metaphycus* (parasites of soft scales). The third publication is a guide to the identification of the families of parasitic wasps (Chalcidoidea) in the Ethiopian Region.

Several collecting trips to the Northern Transvaal, in the course of which the abovementioned specimens were collected, were undertaken.

Bruchidae (seed beetles)

Part of the project will shortly be completed when an M.Sc thesis entitled: "The systematics of some *Acacia* inhabiting Bruchidae (Coleoptera)" is submitted to the University of the Orange Free State.

A key was drawn up for the subfamilies, genera and 23 bruchid species collected from 30 indigenous acacias. The species, seven of which are new, were described or redescribed. A list comprising 36 indigenous *Acacia* species and the identified bruchids associated with the various species was compiled. Biological observations and data on other insects associated with *Acacia* species, such as Lepidoptera, Hymenoptera, Curculionidae and Cerambycidae, were also supplied.

A few bruchids were identified, *inter alia* for museums in Zimbabwe and Copenhagen.

Hymenoptera aculeata

Five field trips to the Northern Transvaal and the South-Western Cape were undertaken and resulted in the addition of approximately 4 000 new accessions, representing the bulk of the aculeata families, to the National Collection of Insects. At present these specimens are being curated into the collection.

The existing aculeata collection is being rearranged; a higher classification, which is more acceptable, is being followed.

During the past season approximately 300 Xylocopidae (carpenter bees) were collected and are being curated and studied. A visit was also paid to the entomological section of the South African Museum and their *Xylocopa* collection thoroughly examined. The taxonomic revision of the Southern African species of *Xylocopa* is receiving attention. Most of the accessions have been sorted into species and where necessary the species are being redescribed.

Tabulation of all the population data from six sites to establish the mortality, the kinds of wood used for nest construction and the biology of natural carpenter bee populations has been

completed. A method of checking the reliability of the data collected is being developed.

Isoptera (termites)

Routine determinations, involving material submitted by the public for naming, amounted to 153 series of Isoptera. The annual increment of termites to the National Collection of Insects (NCI) totalled 81 samples, 77 of which were yielded by the National Survey of Isoptera and four, including a genus and three species not previously represented, were donated by specialists abroad.

At 31 March 1980 the number of termite series deposited in the NCI stood at 33 488.

Two termite/termitophile survey expeditions were undertaken: one to the District of Beaufort West involving the total excavation of 36 nests of *Microhodotermes viator* (Latreille), the other involving 41 nests of a complex of *Odontotermes* species in the Humansdorp district. The yield was 77 colony samples of Isoptera, 89,6% of which were complete with imagos in the form of functioning reproductives and/or alates.

Searches of these termite nests produced 3 677 termitophilous Arthropoda, including Isopoda (23), Thysanura (283), Psocoptera (2), Diptera (10) and Coleoptera (3 359). Some 67 Staphylinidae from a previous parcel of termitophiles hosted by *Macrotermes* spp. were identified and were found to consist of five species, one of which was new and belonged to a genus not hitherto recorded from South Africa.

The distribution, ecology and biology of the wood-dwelling genus *Bifiditermes* in Southern Africa have been treated in a paper that is the eighteenth in a series on the National Survey of Isoptera, the first part of which was published in 1973.

A report was compiled on fossilised nests of Hodotermitidae found in the District of Clanwilliam. These termitaria, which probably were inhabited by stock ancestral to the extant species *Microhodotermes viator*, are shown by carbon dating to have originated in late Pleistocene times, some 32 000 years ago.

Four papers were published during the period reviewed.

Neuroptera (netvlerkinsekte)

During the course of the year several field trips were undertaken to the Northern Transvaal. These have resulted in the addition of over 1 500 specimens of Myrmeleontidae, Nemopteridae and other Neuroptera to the National Collection. Special emphasis was placed on building up the collections of Chrysopidae, Hemerobiidae and Mantispidae, groups previously not well represented in the collection.

Tephritidae

The revision of the Dacinae of Africa is at the stage where most of the morphological and taxonomic sections are almost complete. Many

figures have been prepared and their arrangement is in hand. A precise diagnosis for the Dacinae is presented, but attempts to illustrate differences from groups and species that have been included in the subfamily have had to be reduced to a minimum, indications pointing to another very wide field for investigation.

The Natal fruitfly *Pterandrus rosa* (Karsch) is very prevalent in Pretoria; at one small guava tree, using only one bait-trap, over 600 specimens were caught in six weeks; no more than five specimens of *Ceratitis capitata* (Wied.), the Mediterranean fruitfly, were taken.

At the Citrus and Subtropical Fruit Research Institute at Nelspruit, two specimens of *Hoplophomyia divaricata* Munro were caught in a bait trap; this ceratitine fruitfly was previously only known from Durban, Natal, where it had been taken in bait traps in an avocado orchard. The host plant of the Nelspruit specimens was not discovered.

Specimens of one of the common cucurbit flies, *Didacus vertebratus* (Bezzi), from Gambia were identified for the British Museum.

GENERAL COLLECTION OF INSECTS

Six collecting trips to the nature reserves of the Transvaal Provincial Administration were undertaken during the past year. These investigations are the start of a long-term project that will include an attempted survey of the insect fauna of these reserves. Several thousand specimens have already been collected and pinned up and are housed in the National Collection for permanent preservation and further study.

The qualitative survey of the insects of the Nylsvley Reserve has been continued. This project forms part of an ecological study of this reserve under the aegis of the CSIR. Collecting techniques have been improved during the past year and suction traps, light traps, Malaise traps and pit traps are now chiefly used for acquiring new accessions. Several thousand additional accessions have been obtained by means of material submitted for identification.

The identification service remains one of the most important activities of the unit. During the past year 110 identification tasks were completed; these included about 1 000 identifications. The biggest demand for insect identifications came from Departmental institutes, students, private firms and the general public. A large number of unidentified specimens representative of families of beetles, flies, stink-bugs and wasps were sent to several overseas specialists for naming. Some of this material has already been named and returned and is now regarded as a valuable addition to the Collection.

CHEMICAL CONTROL OF INSECTS

Pesticide dynamics

Dieldrin and endosulfan residues were again found in samples of both beef and mutton. The presence in meat, of residues of these preparations

is not permitted and no registered use can result in these residues. While endosulfan is used to control stalk borers, it is used only early in the season, and its use on stock feeds is prohibited. Dieldrin is used as a soil treatment, but may not be sprayed on plants. In consequence of these findings sales of dieldrin were restricted with effect from January 1980.

A number of bird and fish samples were investigated in collaboration with nature conservation organisations. Although high concentrations of DDE were found in the samples, it has not yet been possible to demonstrate any connection between the residues and the health of the animals. Penguin eggs from St Croix island are being studied at present for the occurrence of insecticides.

A programme of investigation into the occurrence of dithiocarbamate fungicide residues in vegetables and fruit has been launched in co-operation with the City Council of Johannesburg. Inspectors of the City Council took samples on the fresh produce market and the samples were analysed in this laboratory. The results showed that vegetables are free from residues of these fungicides but that some subtropical fruit varieties sometimes contain high concentrations. The preparations are not registered for use on some of the subtropical fruit varieties in which residues were found, e.g. pawpaws; investigation of the matter is continuing.

Further trials were undertaken to determine what the effect of a light shower of rain would be on the efficacy of a pesticide sprayed on shortly before. Endosulfan, carbaryl with and without molasses and cypermethrin were used in trials. Preliminary results indicate major differences in the effect of rain on these preparations.

The addition of adjuvants to pesticides to improve control is a general practice in some industries. Molasses is added to many preparations for the control of pests on cotton, but it is not always beneficial. Trials have shown that a high concentration of molasses may reduce instead of increase the delivery of the active ingredient to the plant. More trials are planned to investigate this reaction further.

Interaction between pesticides is an increasing problem in chemical control methods. For practical reasons pesticides may be applied either together or shortly after one another. The interaction is sometimes detrimental to plants; the plants are damaged and the crop reduced. An investigation is being carried out at present to work out a rapid method of screening for possible detrimental interactions.

At present residue analyses are an expensive and lengthy process. Success with simplified methods has been achieved overseas and an officer has been sent to the institution in question to learn the techniques. Methods have also been worked out by this unit for the determination of several pesticides by the Working Group for Pesticide Residues of the National Programme for Environmental Sciences.

A number of analyses were carried out for other bodies, e.g. aldicarb in potato leaves for the Transvaal Region and organochlorine pesticides in meat for the Department of Health.

Insect pests of cotton

During the year under review four candidate pesticides, namely AC 222, 705, RH 0994, DPX 5444 and Sev/Pilot were received for laboratory evaluation. All these preparations are at various stages of development and will be finalised later in the year.

During the season field evaluation of pesticides was aimed chiefly at -

- (a) determining the effect on cotton of reduced doses administered as part of a weekly praying programme with the synthetic pyrethroid pesticides registered at present;
- (b) determining the effect of such doses on red spider mite populations;
- (c) determining the increase in the yields obtained with synthetic pyrethroid pesticides in comparison with other non-synthetic pyrethroid pesticides.

With the crop results still outstanding, it cannot reliably be concluded that reduced doses produce effective control. According to scouting reports it appears, however, that the synthetic pyrethroids provide effective control at 35 % of the present twice weekly registered dose when the population pressure of American bollworm is normal. Follow-up research is required, however, to determine what the effect would be with severe bollworm infestations.

Results during the season have incontrovertibly demonstrated that all the synthetic pyrethroids have an effect on increased red spider mite populations. This trend was especially evident where synthetic pyrethroids were administered from eight weeks after emergence. With the commercial use of synthetic pyrethroids during the season it appeared that weekly spraying with half the recommended twice weekly dose produce better results where severe infestations of bollworm are experienced during the active growing stage of cotton.

Research on resistance was followed up this season in the North-Eastern Transvaal Lowveld, where poor resistance to American bollworm was reported with the use of endosulfan.

Eggs and larvae were collected in the Letsitele and Messina areas during March 1980. The insects are being bred and multiplied in the laboratory at present before being exposed to endosulfan. The results will be available at the end of the year.

With the predominant use of the broad spectrum synthetic pyrethroids for the control of the pest complex on cotton, and the cross resistance that has already been encountered in other insects between chlorinated hydrocarbon compounds and synthetic pyrethroids, a watchful eye is being kept on the use of synthetic pyrethroids on agricultural crops.

Research on the manipulation of olfactory communication in American bollworm for the

evaluation of population densities in the field has recently been started. At present attention is being given mainly to carrying out behaviour studies on virgin female and male moths.

Preliminary field trials carried out at Rust de Winter during the season in which pheromone traps were provided with virgin female moths and a commercial synthetic pheromone showed that the catches obtained have potential advantages for the application of pheromone attractants as a population monitor.

BIOLOGICAL AND INTEGRATED CONTROL

Stalk borers and American bollworm

A study of the use of biological methods in the control of the American bollworm and grain stalk borers led to six egg parasites being imported and bred on a large scale. These parasites are: *Trichogramma semifumatum*, *T. australicum*, *T. perkinsi* from Columbia, *T. platneri* and *T. pretiosum* from America and *T. brasiliensis* from France. In addition the indigenous parasite *Trichogrammatoidea lutea* is bred on a large scale for laboratory studies and for possible mass release in the field.

Important biological data in connection with the parasites are being collected and laboratory trials have been carried out to develop mass breeding techniques that are as effective and cheap as possible. Of the above parasites, *T. semifumatum*, *T. perkinsi* and *T. brasiliensis* were released at Groblersdal and Rust de Winter, and the effect is being evaluated at present.

It appears from last season's trials that chemical spraying against the American bollworm is frequently unnecessary or uneconomic. The reasons for this may be that the present economic thresholds are too low or that the sampling of the infestations is not satisfactory. A trial was therefore carried out to determine the damage done to cotton by various densities of bollworm larvae. The results of this experiment have not all been collected yet.

These data, together with a comprehensive population study of egg and larvae populations, may form the basis of a better understanding of the economic importance of the American bollworm. A sequential sampling technique was applied at the present economic threshold of 0,5 eggs per plant. With the aid of this technique the number of plants that had to be sampled in order to arrive at a safe decision on whether or not to spray was drastically reduced during the major part of the season. This technique should bring about a considerable saving.

Karoo Caterpillar

Widespread outbreaks of Karoo caterpillar larvae occurred during autumn in the Central Karoo, with the focal point the De Aar - Richmond - Hanover area. Observations of epidemic populations showed an urgent need for a comprehensive study of the role of host plants.

Plant communities clearly differ in their susceptibility to damage, as well as their contribution to the survival of the insect.

Potato tuber moth

Laboratory studies on *Copidosoma koehleri*, one of the parasites introduced fourteen years ago for biological control of the potato tuber moth, showed that in humid conditions the average female has between 2 000 and 3 000 progeny and lives for about three weeks. This high fecundity probably accounts for its great abundance during the latter half of the growing season, when the thick cover of potato plants provides humid conditions.

But it is extremely sensitive to low humidity, and lives for only about a day at 20 % RH. This probably explains why it is rare in the first half of the growing season. If biological control of the tuber moth is to be improved, so that it is effective even when conditions are particularly favourable for the moth, an additional parasite less sensitive to low humidity appears to be needed.

Field studies on integrated control showed that insecticide can be applied up to four times per season without reducing the efficacy of the parasites and that insecticides and parasites together give good control when conditions are particularly favourable for outbreaks of tuber moth.

Plant mites

The exotic predacious mite *Phytoseiulus persimilis*, which was released at several commercial nurseries in the Western Cape for the control of spider mites *Tetranychus* spp. on vegetable and flower crops grown under polythene, has become well established at one release site, despite the frequent application of spray chemicals for the control of insect pests and diseases. Laboratory tests are in progress to determine the resistance which *P. persimilis* appears to have acquired to a range of pesticides.

Pernicious scale

Sampling for the presence of the local parasites of pernicious scale *Quadraspidotus perniciosus* has been carried out at 3-monthly intervals in the Western Cape. The aphelinids, *Aphytis* sp. and *Apidiotiphagus* sp. continue to be the two main emergent parasitic genera.

Vine mealybug

Field samples processed in emergence boxes showed that the natural enemy complex of the vine mealybug *Planococcus ficus* is much less diverse in the Hex River Valley than in the Stellenbosch area. A reservoir of predators exists with other mealybug species and aphids in and around vineyards. A reservoir of parasitoids exists in vine mealybug on edible fig and in citrus mealybug *P. citri* on citrus.

A factorial experiment was laid out in a Barlinka vineyard in the Hex River Valley to

determine which combination of disease prevention

and ant exclusion treatments best enhances the activity of the natural enemies of vine mealybug. Treatments of the same fungicide in different formulations did not produce detectably different mealybug infestations.

It was found to be possible to exclude the ground-nesting pugnacious ant *Anoplolepis custodiens* from the branches of the vine, either by unregistered chemical means or by physical means. Ant exclusion permitted an increase in the percentage parasitism of vine mealybug.

Colonies of 2 species of ant that sometimes nest arboreally on vines, where they attend vine mealybug and presumably hinder natural enemy activity, *Technomyrmex albipes foreli* and *Crematogaster peringueyi*, are being maintained in the laboratory and poison baits for their control are being tested.

Insectary facilities for mass breeding vine mealybug naturally from the Stellenbosch area and from other countries for release in the Hex River Valley are being designed and constructed in such a way as to minimise contamination and allergy problems.

BIOLOGICAL CONTROL OF WEEDS

Hakea

The work on the biological control of *Hakea sericea* is concentrated at present on the evaluation and distribution of the fruit-boring weevil *Erytanna consputa* and on the breeding and establishment of the seed-destroying moth *Carposina autologa* and the shoot-boring weevil *Cydmaea binotata*. Work on a third weevil *Cydmaea* sp., which develops in the buds, has also started.

Field populations of the fruit-boring weevil *E. consputa* have continued to increase and spread at most of the 90 remaining release sites in the Western, Southern and Eastern Cape. On a one hectare experimental plot at Goudini the weevils reduced the fruit production by 28 % during the last season. The populations are still very much in a dispersive phase, so that the amount of damage is expected to increase considerably.

Progress with the establishment of the seed-attacking moth *C. autologa* is still being hampered by the problems involved in mass-rearing the insect. The poor fecundity of the female moths reared on a synthetic diet is suspected of being largely responsible for this. An alternative method of rearing the larvae in fruits in the field is still giving a low return. At present this moth appears to be established at two sites in the field.

Permission was granted for the release of the shoot-boring weevil, *Cydmaea binotata*. The weevil is now being reared in the field at isolated localities around Stellenbosch, from which it will be distributed to other hakea infestations.

Several colonies of the fruit-boring weevil *E. consputa* are surviving on *Hakea gibbosa* in the Kleinrivier Mountains.

St. John's wort (*Hypericum perforatum*)

Work on the biological control of St John's wort presently involves the testing and establishment of new insects and the evaluation of insects already established. Work on the feeding specificity of the St. John's wort aphid *Aphis chloris*, especially with regard to related indigenous genera and species, is continuing.

A small colony of the root-boring beetle *Agrilus hyperici* has been established with material received from the United States of America. Preliminary results from a chemical exclusion trial on *H. perforatum* showed that seedling growth is being suppressed by the activity of the gall midge *Zeuxidiplosis giardi*.

Jointed cactus

Host specificity tests on the newly imported pyralid moth *Mimorista pulchellalis* have been completed and permission has been granted to release this biological control agent in South Africa. It is already established at two localities in the Eastern Cape.

Releases of *Tucumania tapiacola* have continued. To date 673 750 eggs and larvae and 1943 adults have been released. The moth is established at at least two localities in the Eastern Cape. Life table data have made it possible to identify mortality factors which affect progress of the insect in South Africa.

The tables indicate that although 98 % of eggs and larvae fail to survive, the moth still has the potential to increase in numbers and to inflict considerable damage on certain types of plants. It is predicted that the population build-up of the moth will be gradual and damage may only be noticeable on these plants in 10 to 20 years.

Reassessment of the campaign to control jointed cactus by chemical means and its effect on biological control has exposed the following weaknesses in the system:

- (a) Cochineal populations are selectively eliminated from infestations by current spraying techniques, to the detriment of biological control.
- (b) The efficiency of spray operators in locating jointed cactus plants is very low and 21 % to 31 % of isolated joints and small plants are overlooked.
- (c) Small plants and isolated joints receive a big overdose of herbicide when spot-sprayed, which is an important waste factor.
- (d) Optimum chemical control was obtained when spray operations were directed towards large plants and clumps only. Savings of 35 % to 47 % were obtained by this method with only a small (7 %) decrease in overall efficiency.

Prickly pear

Life table analysis of five prickly pear regrowth populations showed that although more of the larger plants were infested with *Cactoblastis cactorum*, mostly small plants were killed. Chemical control of prickly pear regrowth should therefore

be directed towards large plants only. Good progress has been made in the search for an efficient systemic herbicide which can be stem-injected.

Dactylopius opuntiae was less effective than *C. cactorum* in suppressing regrowth.

Imbricate cactus

All chemical and mechanical control of imbricate cactus in the Oudtshoorn district has ceased in view of the excellent level of control achieved by means of cochineal *Dactylopius tomentosus*, which was first released there during 1978.

Large plants in other areas, such as Kimberley and Steytleville, take much longer to die. In order to obtain 100 % control the plants must be felled 24 to 36 months after they have been infested by the insect.

Acacia species

Trichilogaster acaciaelongifoliae (Frogg.) (Hymenoptera: Pteromalidae) is a gall-forming insect of leaves and flower and branch axils of *Acacia longifolia* in Australia. Trials to determine the specificity of the species were carried out on 33 indigenous and 12 Australian *Acacia* spp. *A. longifolia* was used as the control here. The characteristic galls caused by *T. acaciaelongifoliae* have so far developed on only a few of the control trees.

Lantana camara

It has been an exceptionally dry season along the Natal coast. The drought and the two leaf-mining beetles *Uroplata girardi* and *Octotoma scabripennis* and the sucking insect *Teleonemia scrupulosa* have hampered the growth of *L. camara*. The additional pressure on *L. camara* by the competitive weed *Chromolaena odorata* has resulted in complete control of the *L. camara* at the Margate Experimental Plot.

Leptobyrsa decora, a sucking insect, was also released at Buffelspoort, Letaba Estate, Tzaneen and Margate. The stalk borer *Plagiohammus spinipennis* is still being bred in bulk for release. *Phytobia lantanae*, a leaf-mining fly, was received from the CSIRO, Brisbane, Australia, and is being multiplied under quarantine conditions at present.

INSECTS IN STORED PRODUCTS

Pirimiphos-methyl, which was tested as a grain protectant the year before last, was registered for the spraying of maize, grain sorghum and oilseeds, but not for use on wheat, barley and other commodities of which the lesser grain borer is an important pest, because the poison is not effective against this insect. Consequently there was a serious need for an effective preparation to protect wheat during storage. Chlorpyrifos-methyl was regarded as a possibility, and trials with bulk-stored wheat were started during October 1979. Bag stack trials were carried out earlier and the preparation

was registered for use on bag stacks in the interim, but further trials are being carried out at present to obtain additional information on residues. The results of all the trials are promising so far.

The fumigation of grain in silos without gas circulation equipment, using a mixture of carbon dioxide and methyl bromide was tested at four grain elevators. The first results were very promising. They were obtained in a silo tube with a storage capacity of 800 t. Further trials were then carried out in tubes with capacities of 4 000 to 6 000 t. In all three cases satisfactory concentrations of gas could not be obtained in the centre of the tube and the test insects survived there. Further trials will not be undertaken for the time being, but experiments will now be carried out on the use of pure inert gases such as carbon dioxide and nitrogen, which will be let into the tubes from below.

Rust red beetles and confused flour beetles from 88 localities in the Republic have already been tested for resistance to mercaptothion and lindane. Most of these have also been tested for cross-resistance to 10 other poisons, including pirimiphos-methyl, chlorpyrifos-methyl and dichlorvos. No serious cross-resistance to these preparations was found in flour beetles.

Since October 1979 dichlorvos has been tested in two mills as a space treatment preparation, in view of the scarcity and high cost of natural pyrethrum, the traditional preparation for use at mills. This trial has virtually been completed, and the preparation was found very effective in keeping down the insect populations at the mills.

BEE RESEARCH

During the year reciprocal crosses between selected lines were made and tested. However, owing to the extremely dry conditions prevailing on the island the tests were inconclusive and will have to be repeated in the coming year. The exceptionally poor conditions caused high losses of queens in established colonies, which reduced the basis of comparison to an unsatisfactorily low level.

The increased scope of the work, combined with the poor conditions, has exposed the need to improve queen rearing and mating techniques so that variations in yields of batches of newly raised young queens can be largely eliminated. These erratic results have caused considerable problems in view of the tight schedule of planned operations.

The understanding of the role of the individual honey-bee in apple pollination has been taken a step further. Based on 8 hours of "bee working time" in every 24 hours, an apple flower is exposed to pollination for about 1 400 minutes from opening to first petal fall and about 1 700 minutes to last petal fall. There appears to be no preference by the bees for any particular flower in the cluster, so the claimed superiority of the crown or terminal flower is based on horticultural and not pollination reasons.

A test with an attractant for increasing pear pollination did not reveal any significant

improvement in the attractiveness of the treated flowers, nor was there a difference in the set.

The results of the lucerne pollination project indicate that the honey-bee is the major pollinator. Other insects such as *Xylocopids* (carpenter bees), while individually more efficient trippers of lucerne flowers, are more subject to variations in populations, which in any case are very small compared to honey-bee populations.

The monitoring of the Cape honey-bee *Apis mellifera capensis* in various sanctuaries throughout is natural habitat is continuing.

Preliminary research into the movement of marked drones indicates that drones visit a familiar congregation site regularly, so forming a stable proportion of the drone population of that site. Drones marked at one of the congregation sites were recovered in hives 2 km away.

Congregation areas in winter (July) are small and distinct, whereas such sites in early summer (November) are almost indistinguishable, with drones present everywhere. Drones were found to be much less active on windless days in otherwise ideal climatic conditions than on days when there was a breeze.

The presence of more than 500 *Hoplostoma fuligineus* beetles per brood chamber at a boekenhout site led to total destruction of combs, including all the honey and brood. Queens were also lost because workers moved into supers. This demonstrated that this species of beetle should be regarded as a serious pest in some seasons. The beetles are attracted to bee brood first, and devour this before the honey is eaten.

Scale hive records at two sites with indigenous flora revealed how the vegetation reacted to unseasonable rain. At Uitenhage 3 flows were experienced instead of the usual one, while at Edenburg an unusual second flow was experienced from "bossiesveld" during March/April, the first time in seven years of recording.

The latter honey crop was also the largest for the recorded period.

Work on two beeplant publications (i.e. on eucalypts and other beeplants) continued. It is hoped that the publication on eucalypts will be completed by the end of 1980.

POLLINATION OF LUCERNE

A second shed was erected and stocked with carpenter bees and leaf cutter bees for experimental pollination of lucerne at Oudtshoorn. The increase in both carpenter bee and leaf cutter bee numbers was, however, disappointing in spite of the large amount of nesting material available in the experimental sheds.

The carpenter bee *Xylocopa caffra* is increasing rather faster than any lucerne pollinator, but much less quickly than one would expect from the numbers of young females produced. Many of these young females apparently emigrate, but where they go to is not known.

Parasitism is apparently not high enough to check the rate of increase of any of the experimental lucerne pollinators. In the case of *X.*

caffra the only parasite that has been found in the experimental shed so far is *Hyperechia nigripennis* Wiedemann.

FOREST AND TIMBER INSECTS

Defoliators

Although the pine tree emperor moth *Nudaurelia cytherea* occurred in large numbers in plantations in the Western and Southern Cape during the past year, serious defoliation of pines was reported only at a private plantation near Paarl and the Kluitjieskraal State Forest Reserve near Wolseley, where limited control measures are applied locally.

The willow tree emperor moth *Gonimbrasia tyrrhea* again defoliated thorn trees in the Little Karroo and Langkloof areas, although the defoliation was not as severe and widespread as during previous years.

Timber insects

During November 1979 and February 1980 surveys on the incidence of bark beetles were again carried out in the Eastern and Northern Transvaal forestry areas. *Hylastes angustatus* was responsible for the death of small *P. patula* trees in the Sabie and Woodbush districts. No signs of the European bark beetle *Orthotomicus erosus* have been observed in these areas as yet. At present researchers are concentrating on this beetle in the Western Cape. It has been found that *O. erosus* develops successive generations throughout the year and is not merely restricted to three generations per year, as was previously assumed. This accounts largely for the fact that the insect is a potential pest of the local forest industry.

Over 3 000 single cultures of *H. bajulus* were established during the past season. Eggs for these cultures were obtained from both field-collected and laboratory-bred material. Beetles appeared one or two years after inoculation in wood, and the reasons for the differences in cycle length are being investigated at present. In co-operation with the Department of Forestry, a wide range of existing and registered wood preservatives was tested for efficacy against *H. bajulus* by means of the glass plate method. The preparations have shown that after a year of service they are extremely effective against *H. bajulus*. The experiment in question will be repeated annually for the next 10 years in order to gauge the long-term action of the preparations concerned.

The powder post beetle *Lyctus brunneus* is now being very successfully bred in the laboratory and over 100 breeding colonies have been founded. The life cycle of the beetles in suitable wood (maroela) may be as short as three months.

The *Anobium* cultures have been considerably expanded as a result of the acquisition of a large supply of infected material, and it will be possible to do experimental work on the furniture beetle in the course of the year. A wasp, probably *Theocolax formiciformis*, a well-known parasite of *Anobium*

in Europe, has now been discovered in a local culture of the beetle.

APHIDS

The black pine aphid

Cinara cronartii has again been active in pine plantations throughout the entire country, according to population surveys with Moericke traps, which now cover all the forestry areas in South Africa. A wind-break of *Pinus radiata* trees in the Western Cape was so badly infected with the aphid that the trees had to be felled and burnt.

In the course of a survey in the Eastern and Northern Transvaal it was found that trunk constriction of young *P. patula* was caused by the aphid. This narrowing places an additional strain on the tree, which apparently makes the trees susceptible to other insect attacks, especially by bark beetles.

A survey of the aphid and an investigation of its natural enemies is planned for the southern states of the USA., the original home of the aphid.

The pine woolly aphid

The pine woolly aphid *Pineus laevis* was not very important during the year under review. This is probably thanks to the good rains, which created favourable growing conditions for the *Pineus halepensis* trees, since it appears that only pine trees labouring under a handicap of some kind are affected.

ANIMAL PESTS

National Collection of Nematodes

The collection of nematodes was expanded to 16 227 microscopic slides, representing about 66 000 specimens. Four collecting trips were undertaken and a great many nematodes were collected.

A start has been made with a taxonomic study of the genus *Hemicycliophora* and additional material of the genus *Helicotylenchus* (about 1 400 specimens) was studied and identified down to the species level.

During the year under review 1 304 routine seed, soil and root samples were processed. Of this number 432 came from the Division of Plant and Seed Control and the rest from farmers and private and other Departmental bodies.

Virus transmission by nematodes

Populations of some local *Xiphinema* species are still being maintained on suitable host plants under artificial conditions. For *X. index* fig seems to be a better host than grapevine. A series of pot experiments, designed to demonstrate definitely that *X. index* is capable of transmitting grapevine fanleaf virus in this country, was unsuccessful, owing to the unsuitable potting medium used.

This error has been corrected and the experiments repeated. Positive results are expected within the very near future.

Control of nematode virus vectors

In an attempt to control *Xiphinema index* in a replant vineyard, DD soil fumigant was applied during spring 1976 at dosage rates of 900 l/ha, at a depth of 25 cm, and a split shallow/deep treatment (at 25 and 100 cm) with 400 and 1200 l/ha respectively. After an initial depression, nematode populations in the latter treatment recovered to such an extent that by the spring of 1979 they were virtually at the same level as the untreated control. In the shallow treatment populations were considerably higher than in the control plots.

Occurrence of nematodes in irrigation water

An investigation into the dissemination of plant parasitic nematodes, and more especially those that may be virus vectors in irrigation water, was recently initiated. On a regular monthly basis 200 l samples of water are collected from a number of representative rivers, dams or other sources and filtered, and any nematodes present are identified and counted.

All possible precautions are being taken to prevent contamination from outside sources. It is still too early to draw conclusions, however tentative, from data collected.

Nematodes in maize

Of the seven preparations tested during 1978/79 for the control of nematodes in maize, ethylene dibromide (fumigant) and FMS 35001 (systemic insecticide) produced the best results. During the year under review further trials were carried out with the two preparations. It was found that, during a growing period of 77 days, the *Pratylenchus* population showed a 3,7 fold increase on average on maize in treated soil, as against a 12,3 fold increase on maize in untreated soil. It is therefore clear that these two chemical preparations did have an effect on the nematode population. However, no significant difference between the effect of the two different preparations was obtained.

Soil cultivation trials revealed the following:

- (a) The cultivation of maize at various levels of fertilising had no effect on the population.
- (b) By burning any dry matter on top of soil that is infested with lesion nematodes, it was possible to reduce the population by 75 % over a period of four months.
- (c) For a period of 77 days (between plant emergence and about the green mealie stage), 88 % of the lesion nematode population is found in the plant roots and the rest is found in the soil. On average about 48,5 % of the root population and 13,8 % of the soil population consist of immature stages.

Nematodes in potatoes

A survey carried out in the potato-producing areas of Natal revealed no cyst-forming nematodes *Globodera rostochiensis*.

New records of nematodes

Three phytoparasitic nematodes of economic importance were identified for the first time in South Africa. Each has a wide range of host plants: *Tylenchorhynchus claytoni*, which is especially harmful in maize and woody ornamentals, was found in natural veld in Natal and in nursery plants in the Transvaal; *Tylenchorhynchus annulatus*, which is harmful to sugar-cane, was found in unthrifty sugar-cane in Natal; *Merlinius brevidens*, which is mainly a parasite of wheat, was found in wheat in the Transvaal and the Northern Cape, in fruit, beans, tobacco, cotton and lucerne in the Western Cape and in soya-beans, groundnuts and tomatoes in the Transvaal.

National Collection of Arachnida

Accessions of mites amounted to 2810 and those of spiders to 310.

A survey carried out in the maize production area revealed that the two-spotted spider mite *Tetranychus urticae* was a general pest of maize in the Free State and the Eastern and Western Transvaal this year. It used to damage maize only in the Eastern Transvaal.

The red spider mite *Oligonychus coffeae*, which is one of the most important pests of tea and coffee overseas, was collected on tea at Tzaneen for the first time this year.

Cotton mites

No new candidate pesticides were received for laboratory evaluation during the year under review.

Research carried out in field conditions on promising chemical insecticides against *Tetranychus cinnabarinus*, *T. ludeni* and *T. lombardinii* will in future be aimed chiefly at determining the economic importance of red spider mites in cotton. The most important problem in arriving at an economic threshold value, which can be visually measured by the degree of leaf damage in proportion to the population present, under various climatological and plant-physiological conditions, is being intensively researched. The research started only during the second half of the season and results will not be available before the end of the following season.

Field evaluation of two candidate acaricides was carried out at Rust de Winter during this season, using rucksack sprayers. The preparations propargite 55 % EC, a well-known acaricide for the control of red spider mite on pomes and drupes, at an increased dose of 1,125 l/ha and isoxatin 50 % EC at 0,75 and 1,0 l/ha were applied to cotton together with a standard acaricide, triazophos.

All the candidate acaricides provided effective control in comparison with the standard; isoxatin at 1,0 l/ha was the most promising.

The estimation of mite populations in cotton remains the cornerstone of effective control. It has been shown that chemical control of red spider mite should start early to prevent populations from reaching levels during the critical growing stage of cotton at which crop losses and impaired fibre

quality will result. The doses administered should be in accordance with the registered recommendations.

Intensive research on the possible build-up of resistance to the acaricides registered at present for the control of red spider mite on cotton in the Transvaal Middleveld was undertaken during the season. The research comprises an in-depth investigation into the efficacy against the red spider mite of triazophos, which has been recommended for the past seven seasons in the Loskop Irrigation Area. Results will be available only at the end of the following year.

Rodents

Studies on the control of rodent pests in agriculture were continued, using *Tatara brantsii* (Highveld gerbille) and *Praomys* (*Mastomy*) *natalensis* (multimammate mouse) as experimental animals.

Trials with piriminy, a recently developed rodenticide, were carried out with both species at concentrations of 0,5 % and 0,2 %. Excellent laboratory results were obtained with this preparation, with regard to both efficacy and palatability, which showed that it has great potential for use against South African pest species.

Several complaints about moles, which damage vegetable gardens on a small scale, were received during the year and reports on the control of spring-hares and meercats were also received from the Districts of Vrede, Middelburg and Potchefstroom.

PLANT PATHOLOGY

Mycology

Fungus identification

The demand for identifications of fungal specimens from workers in other departments or institutes continued throughout the year. Well over 3 000 specimens were identified: they were mostly plant pathogens and many were interesting or important as serious pathogens. Among these were the following:

A *Phytophthora* sp. on bananas from Northern Transvaal and on nursery stock of *Cussonia paniculata* near Johannesburg; *Perenosclerospora sorghi* on maize near Letsitele, Northern Transvaal and on *Sorghum caffrorum* near Koppies, OFS., both localities previously unrecorded for this fungus; *Phyllosticta maydis* on maize from Delmas; *Ustilago urochloana* on *Urochloa trichopus*, found for the second time in 69 years; *Cephalophora tropica* on *Pennisetum clandestinum*, found for the first time in South Africa.

Of the larger fungi the gasteromycete *Anthurus archeri* was found associated with young *Ehretia rigida* in a nursery and the edible mushroom *Lepiota naucina* appeared in a number of localities around Pretoria. This mushroom has been recorded only rarely in South Africa.

Taxonomy and mycoflora survey

The study of the South African species of *Colletotrichum* was continued. The results are being prepared for publication.

The survey of the pathogenic fungi on lucerne was continued and these results are also being prepared for publication.

Twenty-five new isolates of *Helminthosporium* species from various hosts were added to the collections of this genus in South Africa. Studies of the species present are being continued.

A further survey of fungi on pasture plants in the Karoo was made during the summer of 1979/80. Despite severe drought conditions, a large variety of species and genera were recorded again.

A new project to study the *Phialophora*-like fungi associated with roots of grasses was initiated.

Toxigenic fungi in stock feeds

A total of 52 samples of stock feed were examined for the presence of toxigenic fungi. *Fusarium moniliforme* again proved to be the most common species with toxigenic potential in these samples. *Aspergillus clavatus* was identified from 5 samples of feeds into which sorghum beer residue had been mixed. Other toxigenic species found were *Aspergillus flavus*, *Aspergillus nidulans*, various *Penicillium* species and *Myrothecium* sp.

The ability of *Pithomyces chartarum* to produce sporidesmin in pure culture was investigated further. A total of 157 isolates were tested, six of which proved to be toxigenic. Work on toxigenic fungi is continuing.

Seed-borne fungi

The incidence of mycelial infection of sunflower seed by the headrot fungus *Sclerotinia sclerotiorum* was studied in a number of samples from diseased fields. It was found that up to 50 % of seeds from infected heads could be infected by the fungus. This is much higher than in the case of soya-beans or dry beans.

Unlike the seeds of these latter crops the seeds of sunflowers may be infected without any signs of infection being visible to the naked eye. This increases the possibility that this pathogen will be spread by means of infected seed.

Curatorial work

A total of 306 new specimens were added to the mycological herbarium this year, bringing the total up to 45 705 specimens. This includes a gift of 90 specimens received from Australia.

Twelve specimens were sent on loan to workers in the USA., England, the Netherlands and New Zealand. Seven cultures were received from research institutes overseas for use in the Mycology Section and nine cultures of fungi were identified by specialists in overseas institutions.

Forest pathology

A preliminary survey of diseases in forest plantations in South Africa has been completed. Considerable losses in pine and eucalyptus plantations result from diseases such as *Phytophthora* root rot, *Diplodia pinea* disease, *Verticicladiella* root rot and *Armillaria* root rot. Many less important and unknown diseases occur and should be investigated.

The likelihood of pathogens of pine and eucalyptus entering South Africa from areas in which these trees are native has been acknowledged. Forestry practices should therefore be designed to minimise the effect of new pathogens that may enter the country.

Particular emphasis has been given to *Verticicladiella* root disease of pines. Investigations have resulted in the identification of new pathogenic *Verticicladiella* species.

The association between forest insects and forest pathogens has been recognised as an important aspect of forest pathology. Pathogens such as *Ceratocystis* spp. and *Verticicladiella* spp. have been found associated with pine bark beetles which provide a means for them to spread over long distances.

Significant losses in forest nurseries are caused by a wide range of root pathogens, including *Phytophthora cinnamomi*. Control of nursery diseases can be achieved by improved nursery hygiene, which is particularly important in preventing the spread of pathogens to forest and agricultural lands.

Phytophthora cinnamomi root rot

Surveys of rivers in the Western Cape in 1979 and 1980 indicated that all the major rivers in this region are contaminated with *Phytophthora cinnamomi*. This fungus was also found to occur in the natural mountainous catchment areas of these rivers from which their headwaters originate. Although *P. cinnamomi* is wide-spread in the mountain fynbos, it has been found only in those agricultural areas that are planted to susceptible crops.

Contaminated river water used for irrigation purposes can result in the infection of susceptible crops or the establishment of this difficult to eradicate soil fungus in new areas. Storage of *P. cinnamomi*-contaminated water in farm dams before irrigation reduces the amount of *P. cinnamomi* present. Commercially available water treatment systems involving filtration and/or chlorination have been tested and found suitable for eliminating this fungus from contaminated water.

From plant samples submitted from grapevine nurseries in the Western Cape, it is apparent that *Phytophthora cinnamomi* is present in many nurseries and infections of up to 25 % have been recorded.

P. cinnamomi remains a significant problem in protea nursery material, despite the availability of information on control. In response to the high incidence of *P. cinnamomi* in forest nurseries an

extension bulletin on control measures in forest nurseries has been made available. Efforts to develop a warm water treatment for eliminating *P. cinnamomi* from infected pine seedlings are continuing.

Disease-free bean seed

During the past year the first disease-free bean seed reached the farmer.

At a ceremony held at the Delmas Co-operative, the Director-General of the Department of Agriculture and Fisheries handed over disease-free seed of the cultivars Nep II and Nuweveld to the Minister of Agriculture and Fisheries, on behalf of the Department and the Minister received the seed on behalf of the farmers. The multiplication of six other cultivars is proceeding according to plan and seed should be released shortly.

Attention is being given at present to disease-free green bean seed. The multiplication of four of the cultivars has already progressed so well that the cultivars will be made available to the industry shortly.

Virus diseases of grapevines

The results of an investigation into the elimination of grapevine fanleaf virus in vineyard soils by applying D,D fumigation against the nematode vector *Xiphinema index* have confirmed the inefficacy of chemical control. After three seasons the lightly fumigated and unfumigated plots were found to be 100 % infected, and the heavily fumigated plots were already 63 % infected. Survey studies have shown that the Enzyme-linked Immunoabsorbent Assay (ELISA) can help determine what the re-infection potential of a specific fanleaf virus infected vineyard is. In the case of an 18-year-old Colombar vineyard, where 140 fanleaf infected vines out of a total of 1 049 were traced by means of ELISA, the pattern of fanleaf virus distribution was random, which confirmed the absence of *X. index* and the lack of a progressive distribution. The re-establishment of such vineyards with fanleaf-free material offers a permanent solution.

Further research on the ELISA procedure for the tracing of grapevine fanleaf virus and arabis mosaic virus of grapevine has shown that the sensitivity of the test could possibly be further reduced. It should then be possible to solve problems experienced during the tracing of arabis mosaic virus by means of ELISA. This virus was recently established for the first time in the Republic on hop plantings, and this soil-borne virus has now become very important in a wide range of perennial crops.

Owing to problems with the elimination of heat-resistant races of grapevine leaf roll, grapevine corky bark and grapevine stem grooving in infected commercial cultivar clone selections, the growing of meristem growing points on an artificial medium was investigated. Preliminary results are extremely promising and meristems of under 1 mm of the

most important rootstock cultivars and the scion cultivar Cabernet Sauvignon have already been established.

Virus diseases of pomes and drupes

Further investigations into the incidence of virus diseases in cherry orchards of the Eastern Free State showed that a serrated leaf syndrome in the cherry cultivar Giant Witzenhausen may be ascribed to a race of the pollen-borne prune dwarf virus.

Affected trees die back rapidly. Although this cultivar is not of any economic importance, the adverse effect of prune dwarf virus is an indication of the necessity for avoiding this virus in plantings, especially if the planting of sour cherries is contemplated.

The incidence of cherry twisted leaf in the cultivar Bing was established for the first time.

Preliminary results demonstrate the economic importance of *Prunus* necrotic ringspot virus in the establishment of apricot and peach cultivars in the nursery. Where *Prunus* necrotic ringspot virus occurred in the scion, it produced a hypersensitive reaction in the standard peach rootstock seedling. This reaction was characterised by a gummosis and necrosis of the rootstock and consequent death of the scion material. The poor percentage take experienced in the nurseries could therefore possibly be ascribed to virus-infected scion material.

An attempt has been made to draw up a reliable standard minimum range of indicators for tracing apple chlorotic leafspot virus according to which the virus status of pome cultivars intended for the deciduous fruit plant improvement scheme can be measured. This led to the replacement of all herbaceous plant indicators by the woody indicator *Pyronia veitchii*. In comparison with the latter, *Chenopodium quinoa* was only 36 % reliable. There is every indication that *P. veitchii* could replace the existing international indicators for apple chlorotic leafspot virus.

Further investigations into the incidence of the apple stem grooving virus in the pear cultivar Forelle confirmed the virulent nature of this virus in the indicator Virginia Crab. This led to a re-evaluation of the pear indexing programme in order to determine the possible incidence of apple stem grooving in other pear cultivars.

Fruit symptoms of apple green dimple were observed in local apple orchards for the first time during the past season. The cultivars Starking and Granny Smith are very sensitive to this.

The enzyme-linked immunoabsorbent assay undoubtedly has a wide application in the tracing of viruses that affect pomes and drupes. The large-scale handling of samples and the speed and simplicity of the process make the technique very suitable for monitoring plant improvement schemes. This technique made it possible to trace pollen and seed borne *Prunes* necrotic ringspot

virus directly in apricot, peach, plum and almond leaves.

Legume inoculants

The increasing interest in legumes for feeds is reflected in a constant increase in the quantities of legume inoculant sold annually. Although the number of units marketed this year is already approaching the quarter million mark, developments in the area of legume cultivation are still in the initial stages and progress is not entirely satisfactory.

The quality of inoculants sold by private firms is strictly controlled in that each lot manufactured is monitored by the Plant Protection Research Institute. The very high quality of South African inoculants is therefore guaranteed.

A controversial aspect of inoculant manufacture throughout the world is the method by which the peat carrier is sterilised in the inoculants. An accurate analysis made of inoculants in South Africa during the past three years showed that there is little to choose between steam-sterilised and gamma-irradiated carriers, although peat subjected to 5 M rad gamma irradiation tends to be the most favourable for the survival of rhizobia.

Inoculants for the legumes most commonly grown in South Africa are commercially available. However, the Plant Protection Research Institute supplies small quantities of inoculants for other legumes to research bodies or farmers on demand. Indeed, 562 units of inoculant were supplied for 114 different legumes during the past year.

Diseases of legume pastures

Pasture legumes are attacked by various diseases in South Africa. Disease surveys undertaken in Natal in 1979 showed that various diseases occur in clover pastures. The genera *Uromyces*, *Leptosphaerulina*, *Phoma* and *Stemphylium* were isolated from clover leaves, and *Uromyces*, *Leptosphaerulina*, *Phoma*, *Stemphylium* and *Colletotrichum* were isolated from clover vines. With the exception of *Uromyces*, the rest of these genera were all described on clover in South Africa for the first time.

A severe rootrot broke out in 1979 in clover pastures in the South-Eastern Cape Province, between Bredasdorp and Humansdorp.

Pasture losses of up to 80 % occurred on some affected clover plantings. A number of *Fusarium* spp. were isolated from the infected plant material. In preliminary trials some clover cultivars showed a certain amount of resistance to this disease organism. This matter is undergoing further investigation.

PHYTOSANITARY SERVICES

Plant material in quarantine

Table 1 gives particulars of the kinds and numbers of plant material received at the plant quarantine station at Stellenbosch during the past year.

TABLE 1

Plant material	Number of cultivars
Wine-grapes	14
Table-grapes	1
Peaches	13
Plums	10
Apricots	5
Cherries	3
Almonds	1
Apples	10
Pears	5
Strawberries	3
Hops	11
Olives	4
Berries	4
Seed	4
Total	78

Release of material from quarantine

Grape-vines	1 cultivar
Brambles	2 cultivars
Roses	10 cultivars
Shrubs	1 cultivar

Available foundation material

The development of foundation material of pome and drupes, table-grapes, wine-grapes and stawberries by the Plant Protection Research Institute during the past decade is an outstanding achievement.

Table 2 shows the 165 cultivar clone selections, including the crops mentioned above, that already qualify as foundation material. The value of this material should be seen in the improvement in production and quality per hectare without any additional outlay by the producer.

TABLE 2

Crop	Number of cultivars
Apples	26
Pears/quinces	13
Apricots	8
Almonds	8
Peaches	27
Plums	20
Cherries	18
Table grapes	7
Wine-grape/ rootstocks	34
Strawberries	4

Expansion and new developments - quarantine station at Stellenbosch

On 25 October 1979 the new complex of buildings, glasshouses, heat therapy chambers, plant growth chambers, an electron microscope, gauze compartments for foundation plants and research equipment was officially handed to the Plant Protection Research Institute at Stellenbosch by the Minister of Agriculture.

When these facilities were handed over the following goals were achieved:

1. The provision of research facilities for the keeping and phytosanitary processing of both imported and locally selected or newly bred plant material, in order to guard against harmful exotic and indigenous plant diseases and insect pests.
2. The provision of virus-free propagating material and the establishment of foundation sources for S.A. Super plants, for issue to the deciduous fruit, wine-grape and strawberry plant improvement schemes.
3. The provision of services and information for the tracing and elimination of declared plant diseases and pests in nurseries, and of the necessary researchers and staff to undertake such studies and develop techniques.

The acquisition of these facilities and the attainment of the goals constitute an important milestone in the 25 years of development of the modern concept of plant quarantine and plant improvement. The eighties will see the start of a new era, and the Institute has already made an outstanding contribution to plant improvement. The past ten years have seen the establishment of the first foundation sources of disease-free propagating material, and this is expected to have a considerable effect on the production of high quality deciduous fruit and wine-grape varieties.

Development of quarantine facilities at Buffelspoort

Towards the end of 1976 a start was made with the building up of a quarantine station at the Buffelspoort Experimental Station. Today the quarantine station, which is fenced with security fencing, possesses the following facilities:

1. A glasshouse with eleven separate rooms;
2. an ancillary building with well-equipped phytosanitary and preparation laboratories, offices, and a well-equipped soil pasteurisation room;
3. three lean-tos for potted plant material, i.e. two fibreglass lean-to structures and one lath house; three insect-proof quarantine gauze compartments and one electronically controlled mist bed, which have been constructed under one fibreglass lean-to;
4. a walk-in refrigerator, which was constructed for the storage of seed samples and vegetative propagating material.

The most essential equipment required for soil preparation and the care of plants under closed and open quarantine has already been purchased and includes soil fumigation implements, rotavators and a steam generator and vegetable planter.

Although most plant samples planted under quarantine were imported as seed, a considerable number of vegetative plant samples were imported during the past year, including pines, cassava and mulberries. The most promising cassava propagating material available has already been imported from areas such as Malawi, Australia and South America.

Large quantities of mulberry cuttings have already been imported from Thailand and France,

with a view to establishing a silk industry in national states.

Pine scions have already been imported from two different sources. These includes 331 clones of specially selected genetic material from Zimbabwe.

In all, vegetative propagating material of eight crops has been imported. This material includes 2 203 pine scions, 2 100 mulberry cuttings and material of 88 different cassava lines.

A total of 2 083 seed samples have been planted out under quarantine. Of this number, 621 samples are still under quarantine, 1 456 samples have already been released and six samples destroyed under quarantine. A further 69 imported seed samples were examined in the laboratory for the incidence of specific seed-borne pathogens.

LOCUST CONTROL

Brown locusts

The Karroo, which is the outbreak area of the brown locust *Locustana pardalina* (Walker) suffered severely from drought.

Although no outbreaks were reported, locusts were nevertheless observed at Vosburg on 21 November 1979. Investigations revealed that the population numbers on a few farms, and on four farms in the Fraserburg district, were very high and that the concentrations in places warranted control. In all 132 hopper swarms and 40 flier swarms were destroyed, and 2 030 kg of insecticide was used. Over large areas of the Karroo the numbers of solitary locusts increased and a campaign against fliers from December 1980 to April 1981 is anticipated.

Tropical migratory locusts

Population surveys during April and May 1979 showed that the population numbers of the tropical migratory locust *Locusta migratoria migratorioides* (Reiche and Fairmaire) increased considerably in the districts of Viljoenskroon, Bothaville, Wesselsbron, Odendaalsrus and Bultfontein. The fear that an outbreak of this sort was imminent was confirmed when reports of swarms were received on 28 March 1980 from the Districts of Leeudoringstad, Bothaville and Wesselsbron. However, control measures were instituted only after 1 April 1980.

TECHNICAL ADVICE

The Senior Technical Adviser (Insecticides and Fungicides) to the Registrar (Act 36/1947) attended the 12th session of the FAO/WHO Codex Alimentarius Committee on pesticide residues in the Hague, in view of the importance of pesticide residues on our export edible commodities. Active participation in the activities of this Committee has been maintained throughout the year.

Some 600 applications for registration and amendments to existing registrations of insecticides, fungicides and rodenticides have been reviewed and recommended for registration under Act 36/1947.

The annual departmental communication "A Guide to the Use of Pesticides and Fungicides in South Africa" (215 pages) was extended and updated and appeared during August 1979.

AGRICULTURAL ENGINEERING

FUEL-SAVING CAMPAIGN

The highlight of the year under review was the leading part played by the Division in the fuel-saving campaign, which was launched towards the end of the previous year and lasted six months.

The outstanding characteristic of the campaign was the excellent co-operation between the various interested Departmental and private bodies and agricultural co-operatives.

For the purposes of the campaign the country was divided into seven more or less homogeneous target areas, each with an area committee.

Each target area was divided into subareas of a convenient size and a work team, consisting of specialists from among the officers for the area, scientists from the private sector, farmers etc., was set up for each area. Eventually over 600 specialists were actively engaged in the campaign to assemble factual information, collate it clearly and launch information programmes. All these activities were co-ordinated by a central management committee under the chairmanship of the Director of the Division of Agricultural Engineering.

An evaluation of the campaign, carried out with the aid of questionnaires, revealed interesting facts and findings:

- Approximately 4 850 man days were devoted by extension officers and other specialists to farmers' days, demonstrations, etc.
- Thirty-eight pamphlets on fuel-saving, of which the average impression was about 40 000 copies, were compiled by the Division of Agricultural Engineering and distributed by the Division of Agricultural Information.
- At the conclusion of the campaign 97 % of the farmers were aware of the undertaking.
- Eighty-nine per cent of the farmers had been given technical advice or tips on fuel-saving.

It is generally believed that the campaign has contributed in various ways to the promotion of the more effective utilisation of fuel. On the one hand many farmers, dealers and other interested persons have paid attention to the tips given and the suggested measures. On the other hand, and this is the most important point, the interested persons and bodies have been made aware of the problem and systems, practices, techniques etc. are being far more critically examined with a view to the more efficient utilisation of fuel.



The former Minister of Agriculture, Mr Hendrik Schoeman. He was the speaker when the centre for the testing of tractor safety frames was officially taken into use at the Division of Agricultural Engineering



During practical training at agricultural colleges students spend a considerable deal of their time on making useful articles such as this unit for the solar heating of water



Mechanised irrigation is increasing very rapidly in S.A. This centre pivot system - which can irrigate 80 ha at a time - is one of five mechanised systems in use in the country

SUNFLOWER-SEED OIL AS AN EXTENDER FOR DIESEL FUEL IN AGRICULTURAL TRACTORS

The Republic of South Africa, in common with other non-producers of crude oil, is experiencing a diesel fuel crisis owing to high prices, shortage of supply, political factors and inadequate local production of liquid fuels from coal. The agricultural sector is particularly sensitive to the situation since almost all tractors and prime movers for agricultural production are diesel-fuelled.

To cope with the situation, such measures as fuel-saving and degradation of fuel specifications are inadequate. Clearly, suitable substitute fuels, or diesel fuel extenders, must be sought.

The South African Government has accepted in principle that agricultural products may be utilised to extend and/or replace petroleum fuels. The agricultural industry has the potential to produce sufficient sunflower-seed oil to make an important contribution toward extending diesel fuel, without reducing the supply of sunflower-seed oil required for human consumption. Research with diesel engines has shown that sunflower-seed oil, and particularly an ethyl/ester mixture, is potentially a highly suitable extender of diesel fuel, provided practical problems encountered can be solved.

The Republic produces between 400 000 and 500 000 tons of sunflower-seed per year, mainly for cooking oil, margarine and stock feed. At present 4,3 million hectares of maize is planted but with improved agricultural practices the equivalent maize crop could be produced on some 3,0 million hectares, freeing 1,3 million hectares for the production of, *inter alia*, sunflower-seed oil.

At a conservative estimate 600 litres of sunflower-seed oil could be produced per hectare. To produce the 600 litres of sunflower-seed oil, the on-farm liquid fuel input would be approximately 60 litres, a very favourable ratio.

The energy balance does, however, require further study at policy-making level. The production of additional quantities of sunflower-seed oil requires no new technology and very little extra capital investment in new plant. Furthermore, the lead-time for production expansion is relatively short.

These favourable considerations make it imperative that vigorous efforts be made to pursue the exploitation of sunflower-seed oil.

Preliminary research by the Council for Scientific and Industrial Research (CSIR) on alternative fuels for diesel engines, and subsequent studies by the Division of Agricultural Engineering of the Department have shown that sunflower-seed oil has substantial potential as an extender for diesel fuel. These studies are directed toward exploring the practical exploitation of this potential.

- Research to date has shown that as far as maximum power and specific fuel-consumption are concerned, sunflower-seed oil, both undiluted and blended, compares satisfactorily with diesel fuel. Combustion-chamber deposits and gumming in the fuel system have not been a problem with the 20 % sunflower-seed oil: 80 % diesel fuel blend.
- Coking of injector nozzles is a serious problem leading, *inter alia*, to crankcase oil dilution and lubricating oil problems, as well as to sticking piston rings. The use of a sunflower-seed oil based ester has resolved this problem in a preliminary 100 hour test.
- The atomisation pattern of sunflower-seed oil is inferior to that of diesel fuel, and this phenomenon could possibly be the reason for the coking of injector tips. It is obviously desirable to obtain blends with physical properties comparable with diesel fuel specifications.

Considering the promising results achieved, it is evident that sunflower-seed oil, particularly in the ester phase, is potentially a highly suitable extender or replacement for diesel fuel. Some problems regarding complete combustion still remain to be solved, however, and sunflower-seed oil therefore cannot yet be recommended as a fuel in diesel engines.

Future subjects of investigation will include-

- trials with various blends and esters of sunflower-seed oil to determine the effects on the long-term service life of diesel engines operating under cyclic loads;
- modifications required in fuel-injection equipment;
- different additives for lubricating oils to improve their tolerance of contamination with plant oils;
- suitable farm-size oil expressers and refining and storage practices.

PRODUCER GAS FOR DIESEL ENGINES

Although the use of producer gas in a spark ignition engine is not something new and the gas was used to a large extent during World War II, this principle is not so simple when applied to a diesel engine. Additional practical data are needed.

In the course of its constant efforts to resolve the diesel fuel shortage, the Division of Agricultural Engineering developed and built a prototype down-draught gas generating plant to produce gas from wood-chips.

This gas is then used to operate a 3,6 litre capacity four stroke stationary diesel tractor engine, using a mixture of 35 % diesel plus 65 % gas.

A recent test using this diesel/gas blend revealed only a slight power reduction.

The engine employed in the tests was not modified at all, except for restriction of the

diesel-pump delivery rate to 35 % of the normal consumption.

This is still a prototype producer-gas generator and tests are being conducted to make it possible to evaluate the use of such a generator in practice.

Durability tests must still be undertaken.

OFFICIAL TESTING OF AGRICULTURAL MACHINERY

The Division of Agricultural Engineering serves the farming community, the manufacturers and thereby the entire Republic by carrying out tests on all farm implements and associated equipment, including tractor tests at the only tractor testing station in the world at 1400 m above mean sea level, which the Division runs at Silverton, Pretoria. In the course of the tests a number of farm implements of various makes were tested. After consultations, manufacturers have taken note of the shortcoming of their products and have modified the equipment accordingly.

In addition to the tractors tested during the year under review, a number of fertiliser spreaders and single-kernel planters, boom sprayers, vineyard sprayers and big round-balers were also tested.

Since an increasing number of tractor operators are killed or badly injured annually in tractor accidents in South Africa, roll-over protective structures to protect the operator are becoming increasingly important to protect the operator.

These protective structures consist of a heavy steel frame which is attached to the tractor and which affords the operator far greater protection in the case of a roll-over accident. Since the degree of protection afforded needs to be thoroughly assessed, it is imperative that these frames should be properly tested. The first of these tests was recently carried out. There is a growing interest among local manufacturers as this is the only guarantee they have that their product is of an acceptable standard.

CONTROLLED ENVIRONMENT FACILITIES

After the stage had been reached in South Africa where a fine-controlled environment for plant growth studies could consistently be obtained and properly maintained within the limits required for all facets of plant research, the Division of Agricultural Engineering set about the task of modifying the existing glasshouse facilities as far as time and financial considerations would permit.

The system of installing four air-conditioning units per compartment, wherever possible, which ensures that 90 % of the heating or cooling load could be maintained even when a breakdown of one complete a/c unit occurred was introduced in a number of existing Departmental glasshouses at various institutions where a fail-safe controlled environment was required.

Space and capacity do not, however, permit the installation of four air-conditioning units in all cases.

New quarantine type glasshouses were erected at the CSFRI at Nelspruit and at the Agricultural Research Station at Bethlehem.

One existing evaporative-cooled glasshouse at the College of Agriculture at Middelburg, C.P., was modified using six air-conditioning units per compartment to produce mechanical cooling and electrical heating, all controlled to fine-control limits from a single point inside the glasshouse on the remote control system.

At the Elsenburg College of Agriculture in the Winter Rainfall Region a special glasshouse 12 m wide by 37,5 m long is being designed for erection early in 1981. It will match the style of the building complex which has already been partly erected there.

SHEEP SHEARING

In collaboration with the SA Wool Board and other organisations such as the National Wool Growers Association of South Africa and the Farmers' Brokers (Co-operative) Limited, personnel of the Division of Agricultural Engineering conducted investigations into the wool industry with the aim of setting up a training programme for sheep shearers in the Republic.

The Division became involved with the wool industry for the first time and an engineer, together with an officer from the Grootfontein College of Agriculture, visited Australia to investigate sheep handling facilities, sheep yards, wool-harvesting equipment, chemical de-fleecing, training facilities and methods of sheep shearing, as well as mechanical handling of wool at harbours and wool storage sheds.

In order to ensure that optimum training facilities are provided, the Division is now finalising arrangements for the installation of sheep shearing machines and holding pens for sheep in selected shearing sheds.

SOIL CONSERVATION

During the year under review the Division reviewed several aspects of soil conservation engineering. Several radical adjustments, based on the latest technological developments both in this country and abroad, were made. These included aspects such as procedures and planning and design standards relating to soil conservation structures. Most of the six comprehensive, detailed manuals for soil conservation staff, begun during the previous year, have already been compiled, and three are in print.

Soil conservation works

The Subdivision at Aliwal North, which is responsible for the planning, design and construction of State soil conservation works, completed 10 new works to the value of R600 000 during the year under review, and repairs

amounting to R112 000 were effected to 18 works. All these works are situated in the Orange River catchment.

About 325 similar State works have now been completed on private farms since the commencement of the Soil Conservation Act in 1946. This is in addition to the approximately 200 works constructed on State land in various parts of the country.

Soil conservation research

During the year under review data on rainfall erosivity and crop canopy cover for soil loss estimation purposes were studied and analysed.

The relationship between rainfall erosivity and other rainfall parameters was determined for selected stations and the results used to compile a rainfall erosivity map for the Republic. This map is the first of its kind in South Africa and constitutes a fundamental step in the application of a soil loss equation.

Field measurements of canopy cover for maize, soya-bean and potato crops at the Cedara College of Agriculture and Research Station were analysed and successfully correlated to leaf-area index and various crop characteristics used in soil-loss estimation equations. The results show that a considerable degree of similarity exists between overseas and South African crop cover data.

Three rainfall simulators based on an American design were built by a private firm and commissioned by the Division for the purpose of research into soil losses and demonstration for extension purposes. These simulators have already shown that they can be of considerable value when used to demonstrate the physical processes involved in run-off and soil erosion.

The section based at Aliwal North continued to investigate the reclamation and stabilisation of eroded valleys and flood-plains, utilising various structures and reed vegetative filters. South Africa is a leader in this field and there is wide interest in the research being undertaken.

GRAIN SILO FACILITIES

Staff of the Division serve as technical advisers to the Grain Silo Committee which is responsible for administering State assistance for the provision of grain storage facilities.

A course for grain silo operators is being finalised in collaboration with the grain silo industry. The first course is planned for March 1981.

Feasibility reports for the construction, during 1981, of grain silos to the value of R35 million, with a total storage capacity of 1,3 million m³, were evaluated. The new silos will bring the total capacity of officially financed bulk-storage facilities for grain in South Africa to 10,9 million m³.

The largest single grain-silo project in the Republic of South Africa is presently under construction at Pan Station near Middelburg, Transvaal. This silo will consist of twenty-four bins

with a diameter of 15 m, providing a combined storage capacity of 195 000 m³. The cost of constructing this grain-silo is R5,3 million.

IRRIGATION

The Division has played a prominent role in developing and propagating modern irrigation methods. Particular attention has been paid to improving flood irrigation systems, which are becoming increasingly important as a consequence of their low energy requirement. Work has included the accurate finishing of irrigation beds and a study of the basic principles of furrow-irrigation design methods.

The introduction of low-pressure, low-cost pipes for the distribution of flood irrigation water in preference to surface channels was brought a step closer as a consequence of close collaboration with the private sector.

Mechanised overhead irrigation systems were subjected to intensive evaluation and publications were issued on the pros and cons and management of the various systems. Infiltration problems developed in some areas where low-pressure centre-pivots were utilised and the Division worked closely with manufacturers in overcoming field problems.

Methods of reducing fuel requirements in irrigation were stressed during the fuel saving campaign. Interest shown by farmers during this campaign in information on irrigation methods stimulated the planning of a major information campaign aimed at propagating modern irrigation techniques.

SOYA-BEANS

Research and development work is being conducted on equipment and methods for the treatment of soya-beans in an endeavour to remove the undesirable anti-growth factors from the seed. Exceptionally good results have been obtained.

The anticipated shortage of protein sources for the production of animal feeds in the years that lie ahead makes this a very important undertaking.

LIVESTOCK TRANSPORTATION

The Division is conducting investigations into the engineering aspects of the transportation of livestock in the Republic with a view to having legislation passed as soon as possible to govern all aspects of the transportation of livestock, in accordance with the original request by the Animal Welfare Co-ordinating Committee.

Preliminary results of the investigation have indicated that although there are construction faults in the trucks used for the transportation of livestock, and in the loading and offloading facilities on farms and at slaughter houses and abattoirs, the biggest problem is that the truck drivers are not exercising the required skills when carting livestock.

ADMINISTRATIVE MATTERS

THE ESTABLISHMENT

An indication of the posts in the Department (in the respective Divisions into which posts are divided in the Public Service) as at 30 March 1980, as well as an indication of the number of vacancies in each Division, compared with the position at 30 June 1979 is given in the tables below.

IMPORTANT ORGANISATIONAL AND ESTABLISHMENTS CHANGES

1. The establishment of the Personnel Administration Division was re-organised at the management level with effect from 1 December 1979 and strengthened in order to adapt to changed service requirements.

2. The Durban and Pietermaritzburg Abattoirs were formally closed with effect from 1 September 1979 and the Cato Ridge Abattoir was commissioned with effect from the same date.

3. In view of the enormous increase in the exporting of game, the Department was compelled to expand its meat inspection service. For this reason a Venison Hygiene Control section was introduced in the
4. At the request of the Department, the Commission for Administration granted approval in principle for the introduction of an agricultural industry extension service and an agricultural industry advisory service in the Department. It has not yet been possible to make suitable provision on the establishment, owing to circumstances, but the matter will be finalised shortly.

5. The Administration of the Division of Soil Protection was reorganised with effect from 1 December 1979 in order to adapt to changed service requirements.

6. The Farm Facilities Section of the following Departmental bodies was strengthened with effect from 1 March 1980 in order to adapt to changed service requirements:
- Transvaal Region
Tobacco Research Institute
Animal and Dairy Science Research Institute
Citrus and Subtropical Fruit Research Institute

Division	1979-06-30			1980-03-31		
	Authorised posts	Posts vacant Number	%	Authorised posts	Posts vacant Number	%
Administrative	193	21	10,9	205	30	14,6
Clerical	538	60	11,2	557	05	18,8
Professional	1 504	260	17,3	1 446	247	17,1
Technical	1 779	292	16,4	1 723	408	23,7
General A	78	9	11,5	79	15	18,9
General B	2 304	359	15,6	2 137	386	18,1
Non-classified	157	28	17,8	143	35	24,5
Posts additional to the authorised establishment	66	34	51,5	187	69	36,8
Total	6 619	1 063	16,1	6 477	1 295	19,9

Increase/decrease in the number of authorised posts in the various Divisions over the past five years:

Division	1976-06-30	1977-06-30	1978-06-30	1979-06-30	1980-03-31	Total % increase or decrease (base year =1976)
Administrative	163	172	190	193	205	+ 25,8
Clerical	494	511	514	538	557	+ 12,8
Professional	1 501	1 459	1 470	1 504	1 446	+ 3,6
Technical	1 609	1 660	1 683	1 779	1 723	+ 7,1
General A	84	81	81	78	79	- 5,9
General B	2 220	2 217	2 235	2 304	2 137	- 3,7
Non-classified	150	187	190	157	143	- 4,6
Total	6 221	6 287	6 363	6 553	6 290	+ 1,1

Staff gains and losses

Division	1979-07-01 to 1980-06-30			1978-07-01 tot 1979-06-30		
	Gains**	Losses*	%	Gains**	Losses*	%
Administrative	17	13	+ 23,5	21	13	+ 38,1
Clerical	133	129	+ 3,0	151	123	+ 18,5
Professional	156	130	+ 16,7	135	126	+ 6,7
Technical	256	228	+ 10,9	213	179	+ 15,9
General A	12	20	-66,7	11	14	-27,3
General B	664	644	+ 3,0	538	532	+ 1,1
Non-classified	42	58	+ 38,1	48	56	-16,7
Total	1 280	1 222	+ 4,5	1 117	1 043	+ 6,6

**By "gains" is meant all officers gained by every division, i.e. appointments from outside, promotion and translations from one division to another and transfers from other Departments.

*By "losses" is meant all officers lost by every Division (individually or jointly), including translations and promotions to other Divisions and cases where persons left the service for good, e.g. resignations, deaths, retirements, abscondences and dismissals.

STAFF CHANGES
(SENIOR STAFF)

TRAINING AND STAFF
DEVELOPMENT

RETIREMENTS

The following senior officers left the service on pension, upon reaching the age limit, after long careers:

BURSARY SCHEME

The Department administers a bursary scheme for under-graduate study at local universities from funds donated by the various

Name	Rank	Institution to which attached	Years of service	Date of retirement
Mr J.A. van Niekerk	Assistant Director	Transvaal Region	43	1979-06-30
Mr J.J. Lowes	Assistant Director	Division of Agricultural Information	29	1980-03-31
Dr C.W.A. Belonje	Assistant Director	Division of Veterinary Services	36	1979-10-31

RESIGNATIONS

The following senior officers resigned:

control boards. The table on the next page shows the number of bursaries awarded since 1977, and their monetary value.

Name	Rank	Institution	Date of termination of service
Dr P.F.Fuls	Deputy Director	Soil and Irrigation Research Institute	1979-07-31
Dr D.L. Milne	Assistant Director	Citrus and Subtropical Fruit Research Institute	1979-12-31

PROMOTIONS

Name	Rank	Institution	Date of promotion
Dr A.L. du Pisani	Deputy Director	Soil and Irrigation Research Institute	1980-01-01
Mr G.C. Green	Deputy Director	Soil and Irrigation Research Institute	1979-08-01
Dr A. Pini	Deputy Director	Veterinary Research Institute	1979-12-01
Mr P.M.A Spreeth	Deputy Director	Division of Personnel Administration	1979-10-01
Mr C.S. Villiers	Deputy Director	Division of Technical and Legal Matters	1979-10-01
Mr M.V. Orban	Assistant Director	Division of Technical and Legal Matters	1979-12-01
Mr F.H. Odendaal	Assistant Director	Transvaal Region	1980-02-01
Mr J.N. de Bruyn	Assistant Director	Professional Auxiliary Services Panel, Head Office	1979-11-01
Mr D.J. de Lange	Assistant Director	Soil and Irrigation Research Institute	1980-01-01
Mr M.H.C. Burger	Under-Secretary	Division of Personnel Administration	1979-10-01
Mr J.P.D. van Wyk	Control Computer Operator	Data Processing Subdivision	1979-08-01
Mr J.H. Steenkamp	Chief Organisation and Work Study Officer	Organisation and Work Study Subdivision	1979-12-01

Grants	Number of bursaries		Studies completed	Total monetary value of new grants
	New grants	Total		
Grants up to 1977	46	214	31	R 137 500
Grants up to 1978	33	216	31	R 86 500
Grants up to 1979	37	222	35	R 102 500
Grants up to 1980	34	221	39	R 123 500

IN SERVICE TRAINING

In order to promote efficiency and foster skills and motivation, staff serving on the establishment of the Department underwent the following training:

	Number of officers involved
<i>Administrative courses:</i>	
Induction	146
Supervision	156
Management courses for managerial officers	14
Merit assessment	163
<i>Functional Courses:</i>	
Budgeting objectives	54
Fuel-saving	40
Stock inspection	64
Legal aspects	44
Farm management	39

FORMAL TRAINING

Officers of the Department are afforded ample opportunity to improve their academic qualifications at Government expense, for purposes of appointment, promotion and self-development, as is evident from the following table:

<i>Diploma training:</i> Technicians and meat inspectors	
Undergoing training	188
Training completed	50
<i>Formal in-service training:</i> meat examiners	
Undergoing training	32
Training completed	9
<i>Post-graduate study:</i> (Local universities:	
Exempted for study (1980):	
B.Sc. (Hons.)	2
B. Agric. (Hons.)(Inst/ Agrar)	7
B.Sc. (Agric.) (Hons.)	23
Studies completed (1979):	
B. Agric. (Hons.) (Inst/ Agrar)	7
B.Sc. (Agric.) (Hons.)	21
B.Sc. (Hons.)	3
<i>Diploma training</i> (optional)	
Public Administration, State Accounts and Finance, Cost Accounting	17

VII. Annexures

(1) ORGANISATION AND FUNCTION OF THE DEPARTMENT

(a) HEAD OFFICE

(Agricultural Building, Beatrix Street/Private Bag
X116, Pretoria)

Management

Dr D.W. Immelman: Secretary

Directorate of Agricultural Technical Services

Dr D.J. Agenbach: Chief Director (Chairman)
Dr J.C. Strydom: Chief Director (Horticulture)
Prof S.A. Hulme: Chief Director (Crops and
Pastures)
Dr J.E. Erasmus: Chief Director (Agricultural
Resource and Farming Development)
Dr W.J. Hugo: Chief Director (Animal Production)
Mr E. Strydom: Chief Director (80.06.01)
(Horticulture)

Administrative Branch

Mr B.W. Viljoen: Senior Deputy Secretary

Personnel and Training

Mr J.C. Visser: Deputy Secretary
Mr P.M.A. Spreeth: Under Secretary (Personnel
Administration)

Auxiliary Services

Mr L.J. Botha: Deputy Secretary
Mr G.J. Smit: Data Processing Manager
Mr M.D. Meyer: Under Secretary (Sundry
Services)
Mr J.H. Steenkamp: Chief Work Study Officer
(80.04.01)

Technical and Legal Affairs

Mr B.J. Dreyer: Deputy Secretary
Mr A.C. Bosch: Under Secretary (Technical
Administration)
Mr C.S. de Villiers: Under Secretary (Statutory
Control)
Mr P.J. Loubser: Under Secretary (Legislation and
Parliamentary)
Mr G.M. Botha: Under Secretary (Foreign Affairs)

Finance

Mr P.F. Nortjé: Chief Accountant
Mr J.J. Lombard: Assistant Chief Accountant
Mr N.J.J. Pretorius: Assistant Chief Accountant

Mr P.J. de Lange: Assistant Chief Accountant
(80.08.01)

Mr M.J. de Vos: Assistant Chief Accountant

Objective Budgeting

Mr H.F. van Zyl: Under Secretary

Departmental Inspectorate

Mr H.J. Kriek: Inspector

(b) SUBDIRECTORATE

Dr A.D. Nieuwoudt: Director (Co-ordination of
Irrigation)
Dr J.J. du Toit: Deputy Director (Co-ordination of
Agricultural Research)
Mr R.W. Nott: Deputy Director (Co-ordination of
Agricultural Resource Development)
Mr A.B. Bridgens: Deputy Director
(Secretary-General, SARCCUS)
Dr J.P. Jooste: Deputy Director (Biometry
Services)
Dr N.J. Robbertse: Deputy Director (Training)
Dr M.K.S.L. von la Chevallerie: Deputy Director
Mr J.A. Swart: Assistant Director
Mr P.F. du Toit: Deputy Director (80.05.01)

Crops and Pastures Institute

Prof A.J. Pienaar: Director
Dr J.W. Snyman: Assistant Director
The Institute does not itself engage in research but
gives guidance to research workers engaged in
research in the different regions on summer
grain, winter grain, other agricultural crops,
pastures and pasture crops, and co-ordinates
all research in this connection. The
co-ordination of weed and poisonous plant
research at the national level, as well as
supplying technical information in connection
with weedicides, is also a function of the
Institute.

(c) FOREIGN REPRESENTATIVES

Paris (South African Embassy, 59 Quai D'Orsay,
75007 Paris, France)
Dr J.G. Boyazoglu: First Counsellor (Agricultural
Technical)
Mr J.A. Thomas: Counsellor (Agricultural
Technical)
Mr J.U. Rietman: Attaché (Agricultural Technical)
Dr J. le Roux: Attaché (Agricultural Technical)

London (South African Embassy, Trafalgar Square,
London WC2N 5DP, England)

Dr. A.C. Myburgh: Counsellor (Agricultural Technical)

Washington (South African Embassy, 3051 Massachusetts Avenue NW, Washington DC 20008, USA)

Dr J.E. Nel: Attaché (Agricultural Scientific)

Canberra (South African Embassy, Rhodes Place, Yarralumla, Canberra ACT 2600, Australia)

Mr J.H. P'Ons: Counsellor (Agricultural Technical)

(d) SPECIALISED RESEARCH INSTITUTES

Soil and Irrigation Research Institute

Belvedere Street, Private Bag X79, Pretoria

Dr M.C. du Plessis: Director

Dr C.N. MacVicar: Deputy Director (Pedology and Irrigation Planning)

Dr C.E.G. Schutte: Assistant Director (Analyses)

Mr J.F. Eloff: Assistant Director (Pedology)

Mr J.A. Stofberg: Assistant Director (Irrigation Planning)

Dr A.L. du Pisani: Assistant Director (Agricultural Meteorology)

Dr G.C. Green: Assistant Director (Soil and Agricultural Water Research)

Dr A. Streutker: Assistant Director (Water relationships)

Mr D.J. de Lange: Assistant Director (80.08.01) (Organic analysis)

The Institute is responsible for the classification of the soil and climatic resources of the Republic and also basic research with regard to the physical and chemical characteristics of soils on a national level. Soil surveys for irrigation projects and investigations into physical soil characteristics are also undertaken - particularly where brack and waterlogging conditions occur. In addition, the Institute undertakes chemical soil, water and plant material analyses, not only for this Department but for other State Departments, provincial administrations and other bodies. The Institute is also responsible for the inspection and analysis of fertilisers, stock feeds, stock remedies and agricultural remedies in terms of Act 36 of 1947. It is also responsible for basic irrigation research, and the agricultural evaluation and planning of irrigation areas. All agricultural meteorological research and data collection also falls under this Institute.

Plant Protection Research Institute

Agricultural Building, Beatrix Street, Private Bag X134, Pretoria

Dr I.H. Wiese: Director

Dr D.P. Annecke: Deputy Director

Mr I.G. Venter: Assistant Director (Locust Control)

Mr H.P. van Heerden: Assistant Director (Phytosanitary Services)

Dr B.W. Strydom: Assistant Director (Plant Pathology/Microbiology)

Mr D.J. Engelbrecht: Assistant Director (Virus Research)

Dr D.P. Keetch: Assistant Director (Entomology/Zoology)

Dr H.A. van de Venter: Assistant Director (Biological control)

The Institute is broadly responsible for advanced research and research at the national level on plant pathology, insect and animal pests and their control. This includes microbiology, taxonomy of fungi, identification of virus diseases, the freeing of propagating material from viruses, honey-bees, insects in stored grain, forest and timber insects, taxonomy of insects and nematodes, economic zoology, toxicology of insecticides and the biological control of insect pests and weeds. The Institute is also responsible for the examination and control of imported plant material and the control of migratory locusts. The Institute uses the research stations and experimental farms at Rietondale (Pretoria), Buffelspoort (Marikana), Fleurbaix and the quarantine station (Stellenbosch), as well as the research units for the control of prickly pear and jointed cactus at Uitenhage and forest pests at Rosebank (Cape Town).

Botanical Research Institute

Private Bag X101, Pretoria

Dr. B. de Winter: Director

Dr D.J.B. Killick: Deputy Director

Dr D. Edwards: Assistant Director

The Institute undertakes basic research on the flora and vegetation of South Africa with emphasis on taxonomy, morphology, ecology and economic botany. The Institute also controls the Botanical Garden at Brummeria (Pretoria) and herbaria in Durban, Grahamstown, Kimberley, Pretoria, Stellenbosch and Windhoek.

Citrus and Subtropical Fruit Research Institute

Private Bag X11208, Nelspruit

Dr J.H. Grobler: Director

Mr A. van Oostrum: Deputy Director

Assistant Director: vacant

The Institute is responsible for country-wide research on all aspects of the citrus and subtropical fruit industry, as well as nuts, tea, coffee and herbs. The Institute also undertakes research at the research stations and experimental farms Addo (Eastern Cape), Burgershall, Citrusdal, East London, Friedenheim, Levubu (Louis Trichardt), Messina and Rustenburg.

Horticultural Research Institute

Private Bag X293, Pretoria

Dr A.J. Heyns: Director (80.06.01)

Dr J.T. Meynhardt: Deputy Director

Mr O.J. Olivier: Assistant Director

The Institute is responsible for all applied and fundamental research and extension on vegetables, cut-flowers, ornamental plants and shrubs throughout South Africa and on deciduous fruit and table grapes in the summer rainfall areas. The Institute controls research stations for vegetables, flowers, decorative plants, table grapes and deciduous fruit research at Roodeplaat in the Transvaal Middleveld and for cherry and deciduous fruit at Emperani, near Ficksburg. In addition the Institute undertakes research on vegetables in the winter rainfall area at Elsenburg, Outeniqua and Lutzville, as well as at Glen in the Orange Free State, at Nelspruit in the Transvaal Lowveld, at Cedara in Natal and at Addo in the Eastern Cape. Research on indigenous flowers, mainly proteas, is undertaken at Elsenburg and at the Tygerhoek Research Station near Riviersonderend.

Tobacco Research Institute

Kroondal, Private Bag, Rustenburg

Dr D.J. Rossouw: Director

Dr W.J. Pienaar: Deputy Director

Dr M.P. Lamprecht: Assistant Director

The Institute is responsible for research, including technological aspects, in the interests of the tobacco industry in all parts of the country. The Institute also undertakes research work on research Stations and experimental plots at Groblersdal, Hartebeespoort (Brits), Nelspruit, Oudtshoorn, Potgietersrus and Stellenbosch.

Veterinary Research Institute

Post Office Onderstepoort, Pretoria

Dr R.D. Bigalke (80.07.01): Director

Dr C.J. Howell (80.10.01): Deputy Director

Dr T.W. Naudé: Deputy Director

Dr A.J. de Vos (80.10.01): Assistant Director (Parasitology and Reproduction)

Dr D.W. Verwoerd: Deputy Director (Virus Diseases) (Personal)

Dr C.M. Cameron: Assistant Director (Bacterial and Protozoic Diseases)

Dr J.G. Pienaar: Assistant Director (Pathology)

Dr B.J. Erasmus: Assistant Director (Professional/Technical Auxiliary Services)

Dr L.A.P. Anderson: Assistant Director (Biochemistry)

Mr F. Visser: Special Grade Control Technician (Vaccine Production)

Mr K.P. Naudé: Assistant Director (Administrative)

The Institute is concerned with research on diseases of stock and game (infectious and others,

including diseases caused by malnutrition), diagnostics, the preparation of vaccines and diagnostic aids, and the biological evaluation of dips and remedies submitted for registration.

Animal and Dairy Science Research Institute

Private Bag X2, Irene

Dr J.H. Hofmeyr: Director

Dr J.C. Oosthuizen: Director (Personal)

Dr P.E. Lombard: Deputy Director

Mr B.R. Grobler: Assistant Director (Stock Improvement)

Dr J.G. Cloete: Assistant Director (Animal Physiology and Nutrition)

Mr W.C.J. Viljoen: Assistant Director (Poultry Science)

Dr J.H. Labuschagne: Assistant Director (Dairy Research)

Dr H.A. Lück: Assistant Director

The Institute, at various centres throughout the country, undertakes at the national level performance and progeny testing as well as fundamental research on the breeding, feeding and physiology of farm animals. The Institute is also responsible for dairy and poultry research on a country-wide basis as well as for the training of dairy technologists at Glen. The Institute has at its disposal a main research station at Irene, undertakes poultry research at Potchefstroom, Elsenburg, the University Experimental Farm at Pretoria and Cedara, and controls random testing of poultry at Irene and Glen as well as pig-testing stations at Irene, Cedara and Elsenburg, and bull-testing stations at Queenstown and Omatjenne (South West Africa).

Fruit and Fruit Technology Research Institute

Private Bag X5013, Stellenbosch

Dr P.G. Marais: Director

Dr A.J. Heyns: Director (Personal)

Dr J.H. Terblanche: Assistant Director (Research/Table grapes, Horticulture, Plant Improvement, Plant Pathology and Entomology)

The Institute is responsible for research on deciduous fruit, table grapes and certain aspects of proteas in the winter rainfall area, as well as for research at national level in connection with certain technological aspects of fruits and other agricultural products. The Institute further renders a radiation and radio-isotope service in connection with agricultural problems in the winter rainfall complex. The Institute controls the research stations and experimental farms at Groot Drakenstein (Bien Donnè), Citrusdal, De Doorns, Elgin, Langkloof, Paarl and Robertson.

Oenological Viticultural Research Institute
Private Bag, Stellenbosch, C.P.

Dr J. de V. Burger: Director
Dr J. Deist: Deputy Director
Dr P.C. van Rooyen: Assistant Director
Mr C. Kok: Assistant Director

The Institute is responsible for all research in the sphere of oenology and viticulture for the winter rainfall area, and all viticultural research in the Lower Orange River area. For this purpose the Institute has at its disposal research stations at Stellenbosch (Nietvoorbij) and Robertson, as well as experimental vineyards at Upington and Lutzville. The Institute controls the historic wine farm Groot Constantia.

(e) DIVISIONS

Division of Agricultural Engineering

Private Bag X515, Silverton

Mr J.J. Bruwer: Director
Mr C.T. Crosby: Chief Engineer
Dr B. van D. Boshoff: Chief Engineer
Mr P.J. Pienaar: Assistant Chief Engineer (Soil Conservation Works - Aliwal North)
Mr F.J.C. Hugo: Assistant Chief Engineer (Mechanization: Plant Production)
Mr J. Veenstra: Assistant Chief Engineer (Mechanization: Animal Production)
Mr C.J. van Schalkwyk: Assistant Chief Engineer (Farm Development)
Mr I. Scheepers: Assistant Chief Engineer (Winter Rainfall Complex - Stellenbosch)
Mr J.H. Eckard: Assistant Chief Engineer (Irrigation Engineering)
Mr H.W.P.W. Struck: Assistant Chief Engineer (Soil Conservation Engineering)

The Division has a specialised task and devotes itself to all engineering problems in the agricultural industry such as mechanisation, (farm power and machinery), soil conservation, water utilisation, farm structures, handling of material, storage of grain, cold storage and processing of fruit, vegetables and other assigned products, as well as all other engineering services with which the Department is concerned, such as the preparation and development of plots on irrigation schemes. In addition to providing construction, utility, expert extension, regulatory and testing services in the above connection, the Division also undertakes related research.

Division of Agricultural Information

Agricultural Building, Private Bag X144,
Beatrix Street, Pretoria

Mr R.J. van Niekerk: Director
Mr Q. Momberg: Deputy Director (Publications)
(80.10.01)
Mr L.L. Lötter: Assistant Director (Information)

The function of the Division is the distribution of agricultural information by the mass media. For this purpose use is made of scientific and popular agricultural publications, radio programmes, audiovisual aids and press releases. The Division is also responsible for the maintenance of an agricultural information bureau.

Division of Plant and Seed Control

Agricultural Building, Beatrix Street, Pretoria

Mr J.F. van Wyk: Director
Mr D.C. Lourens: Deputy Director
Mr A.J. Cronjé: Assistant Director (Quality Control)
Mr L.J. Grobler: Assistant Director (Inspection and Control Services)

The functions of this Division include the protection of propagation material and the assurance of its quality. The Division administers the Seeds Act (Act 28 of 1961), The Plant Breeders' Rights Act (Act 22 of 1964) and the Agricultural Pests Act (Act 3 of 1973).

Division of Soil Protection

Agricultural Building, Beatrix Street,
Private Bag X120, Pretoria

Mr C.R. Baard: Director (w.e.f. 79.05.01)
Mr J.L. Vosloo: Deputy Director
Mr M.L. Heyns: Assistant Director (Land and Weed Control)
Mr T. Brenkman: Assistant Director (Administrative)

The Division is responsible for the administration of the Soil Conservation Act (Act 76 of 1969), the Weeds Act (Act 42 of 1937), and the Subdivision of Agricultural Land Act (Act 70 of 1970). The Division also administers the following assistance schemes in terms of the Soil Conservation Act: the Financial Assistance Scheme, Flood Assistance Scheme, Stock Reduction Scheme, Veld Reclamation Scheme and Grass Ley Scheme.

Division of Veterinary Services

Transvaal Agricultural Union Building,
28 Struben Street, Private Bag X138, Pretoria

Dr J.P. van der Merwe: Director
Dr J.D. Coetzee: Deputy Director
Dr J.M. Erasmus: Deputy Director
Dr A. van Heerden: Assistant Director (Major Disease Eradication Schemes and Notifiable Diseases)
Dr G.C. Dent: Assistant Director (Import and Export Control, Bantu Veterinary Services and Border Control and Nagana Control)
Dr P.P. Bosman: Assistant Director (Regional Diagnostic Services, Training, Extension, Non-notifiable Diseases, A.I. Services, Liaison and Publications)

Dr A.E. Gillespie: Assistant Director: (Meat Hygiene and Related Matters)
 Dr W.M.H. Löwe: Assistant Director (Highveld Region - Potchefstroom)
 Dr E.O. le Riche: Assistant Director (Winter Rainfall Region - Stellenbosch)
 Dr R.R. van der Veen: Assistant Director (Free State Region - Bloemfontein)
 Dr F.B.W. du Casse: Assistant Director (Transvaal Region - Pretoria)
 Dr L.R. Hurter: Assistant Director (Northern and Eastern Transvaal Region - Pietersburg)
 Dr C.J. Coetzee: Assistant Director (Stock Disease Control)
 Dr H.H.P.A. Schneider: Assistant Director (SWA Region, South - Windhoek)
 Mr. F. Huisman: Assistant Director (Administrative)
 Dr C. van N. Jonker: Assistant Director (Eastern Cape and Karoo Region - East London)
 Dr P.J. Posthumus: Assistant Director (Natal Region - Pietermaritzburg)

The Assistant Directors of the Regions are under the direct control of the Director. The Division has a specific task in regard to animal health as laid down in the Animal Diseases and Parasites Act, 1956 (Act 13 of 1956) and regulations promulgated in terms thereof. The Division guards against the introduction of diseases by erecting, patrolling and maintaining game- and cattle-proof fences on the borders of the Republic and South West Africa and by controlling animal imports. For domestic protection regular inspections of all stock are carried out. The promotion of animal health schemes to eradicate certain diseases and animal health in general enjoy high priority. The Division also has four Regional Veterinary Laboratories throughout the Republic and South West Africa for local investigation of stock losses, problems relating to animal health and suboptimal production and reproduction. In terms of the Animal Slaughter, Meat and Animal Products Hygiene Act, 1967 (Act 87 of 1967), the Division is responsible for the promotion and maintenance of hygiene in cattle slaughterings and handling of meat and animal products, for preventing the transmission of diseases to human beings and animals by disease-infected animals, meat or animal products, for preventing cruelty to animals slaughtered at abattoirs and for controlling the importation of meat.

(f) AGRO-ECOLOGICAL REGIONS

The eight Regional Organisations of the Republic, as well as of South West Africa, are responsible within their respective geographical areas, for the planning, development, promotion and application of farming systems based on optimal land utilisation.

Each of these organisations provides an extension service in which the soil conservation effort is integrated and which also covers every aspect of farming. The research services are directed to the collation and releasing of scientific knowledge for the optimal utilisation of the natural agricultural resources. The research personnel are also responsible for specialist extension work and for supplying training services to the agricultural colleges.

Eastern Cape Region

P.O. Box 233, Queenstown

Mr H.S. Niehaus: Director
 Dr A.D. Venter (80.04.01): Deputy Director
 Mr J.L. van der Walt: Assistant Director (Research)
 Mr B.J. Krige: Assistant Director (Extension)
 Research stations: Dohne (central research station) at Stutterheim, and Bathurst (Port Alfred). A number of experiments are also conducted at East London.

Free State Region

Agricultural College, Glen

Mr T.E. Skinner: Director (w.e.f. 79.06.01)
 Mr G.W. Oosthuysen: Deputy Director
 Dr P.J. Niemann: Assistant Director (Research)
 Mr D.J. Hattingh: Assistant Director (Extension)
 Mr G.W. Long: Assistant Director (Administrative)
 Glen College of Agriculture: Research stations and experimental farms: Glen (central research station), Armoedsvlakte (Vryburg), Koopmansfontein (Barkly West), Rietrivier (Herbert), Sandvet, Sydenham, Upington Complex and Vaalharts (Jan Kempdorp).

Highveld Region

Private Bag X804, Potchefstroom

Dr J.D. Slabber: Director
 Dr J.E. van Niekerk: Deputy Director
 Dr W.P. Grobbelaar: Deputy Director (Summer Grain Centre - Potchefstroom)
 Mr J. de Kock: Assistant Director (Summer Grain Centre - Potchefstroom)
 Mr J.D. Basson: Deputy Director (Small Grain Centre - Bethlehem)
 Mr G.J. Carstens: Assistant Director (Small Grain Centre - Bethlehem)
 Mr K.W. Pakendorf: Assistant Director (Small Grain Centre - Bethlehem)
 Dr J.J. Coetzee: Assistant Director (Extension)
 Mr M.C. Walters: Assistant Director (Research)
 Mr S.W.B. van Rensburg: Assistant Director (Administrative)

Grootfontein College of Agriculture. Research stations and experimental farms: Potchefstroom complex (central research station), Bethlehem and Swartrand (for gousiekte research) at Ventersdorp.

Karoo Region

Agricultural College, Grootfontein,
Middelburg, CP

Dr P.W. Roux: Director

Mr D.J. van Z. Smit: Deputy Director

Mr J.A.A. Baard: Assistant Director (Research)

Dr A.J. Siepker: Assistant Director (Extension)

Grootfontein College of Agriculture. Research
stations, experimental farms: Grootfontein,
Middelburg, CP (central research station),
Carnarvon, Tarka Conservation Area, Hales
Flats and Jansenville

Natal Region

Private Bag X9021, Pietermaritzburg

Mr P. Hildyard: Director

Mr R.H. Peard: Deputy Director

Dr J.W.C. Mostert: Assistant Director (Research)

Dr D.M. Scotney: Assistant Director (Extension)

Cedara College of Agriculture. Research stations,
experimental farms: Cedara (Central Research
Institute), Drakensberg Complex, (Estcourt);
Northern Natal (Dundee); Kokstad and
Pongolapoort (Makatini).

Transvaal Region

Agrivaal Building, Cor Edmund and Hamilton
Streets, Private Bag X180, Pretoria

Mr D.F. de Wet: Director

Mr S.J. Gericke: Deputy Director

Assistant Director (Research) vacant

Mr W.H. de Vos: Assistant Director (Extension)

Mr F.H. Odendaal: Assistant Director
(Administrative)

Research stations, experimental farms: Roodeplaat
(central research station), Rietondale, Soutpan
(Pretoria), Athole (Amsterdam), Loskop
(Groblersdal), Mara (Louis Trichardt),
Messina, Nooitgedacht (Ermelo) and
Towoomba (Warm Baths).

Winter Rainfall Region

J.S. Marais Building, Private Bag X5023,
Stellenbosch

Dr J. Serfontein: Director (w.e.f. 79.06.07)

Dr P.J.S. Pieterse: Deputy Director

Mr A. Viljoen: Deputy Director

Mr G.P. Kleynhans: Assistant Director
(Administrative)

Dr C.F. Sievers: Assistant Director (Research)
(80.04.01)

Stellenbosch-Elsenburg College of Agriculture.
Research stations and experimental farms:
Elsenburg, Mariendal and Welgevallen
(Stellenbosch), Langgewens (Moorreesburg),
Nortier (Lambert's Bay), Oudtshoorn,
Outeniqua (George), Tygerhoek
(Riviersonderend) and the Veld Reserve at
Worcester.

(2) AGRICULTURAL TECHNICAL RELATIONS WITH FOREIGN COUNTRIES

1. CO-OPERATION WITH AFRICAN STATES

(a) Conferences and meetings of SARCCUS attended

Number of meetings	Number of officers
10	31

With the exception of two meetings held in
Malawi and one held in Botswana, the Republic
was the host at all other meetings.

(b) Visits to African countries

Number of countries visited	Number of officers
5	13

2. OVERSEAS VISITS

(a) Attendance at congresses, meetings and symposia

Number of gatherings	Number of countries	Number of officers
29	20	33

A strong South African delegation attended
the 5th International Symposium on Ruminant
Physiology in France, and Dr B.J. Erasmus of the
Veterinary Research Institute attended a
symposium on bluetongue on the invitation and at
the expense of the American Department of
Agriculture in the USA:

(b) Study tours and official visits

Number of tours	Number of countries visited	Number of officers
37	19	38

These tours included, inter alia, a 15-day visit
to Paraguay by three officers led by Dr J.D.
Burger, Director of the Oenological and
Viticulural Research Institute, at the expense of
the Department of Foreign Affairs and
Information. The officers investigated possible
assistance and co-operation in the field of
agriculture, with the emphasis on grape farming
and wine production.

Mr J.J. Bruwer, Director of the Division of
Agricultural Engineering, accompanied by Mr
F.C.J. Hugo, visited Germany on the invitation and
at the expense of the University of Aschen, for
discussion on the Division's current research
regarding the use of vegetable oils and the use of
ethanol/methanol as an alternative fuel in tractors.

3. SCIENTIFIC AND OTHER VISITS

Number of visits	Number of countries	Number of officers
51	15	79

Visits to the Department included, inter alia, four farmers' groups and the Executive Committee of the International Seed Judges' Federation. A visit that deserves special mention is that of Dr J. Poly, Director-General of Agriculture and Rural Research Institute in France, to whom the decoration of the "Order of Good Hope Grand Officer Second Class" was awarded by the Minister of Agriculture by virtue of his tremendous contribution towards the promotion of collaboration between France and South Africa in the field of agriculture.

4. VISITORS FROM AFRICAN COUNTRIES

Number of visits	Number of countries	Number of officers
14	6	18

These visits were mainly connected with gaining information in the agricultural technical sphere.

REPRESENTATION ABROAD

The accompanying table gives particulars of the activities of the various overseas representatives of the Department during the year under review.

Nature of activities	Europe	Washington	Canberra
1. Visits to research institutes, farms, experiment farms, etc.	146	39	57
2. Conferences and meetings attended	69	30	14
3. Reports on special investigations	26	72	2
4. Reports and publications furnished to the Department and other institutions in the RSA	4 788	6 626	743
5. Number of visitors from SA			
a. for whom travel plans and the most important arrangements were made	97	12	1
b. to whom general assistance was given	89	36	8
6. Interviews granted to non-South Africans	147	13	4
7. Scholarship and other South African students to whom assistance was given	4	7	0
8. Material despatched to SA -			
a. plant material (number of cultivars and/or separate seed samples)	533	2 340	24
b. animal material	50	2	0
9. Newsletters compiled and despatched to the Department	450	25	13

(3) FINANCES

(a) EXPENDITURE 1979/80

	Vote R	Expenditure R
Administration	10 981 000	11 080 649,55
Plant production promotion	12 078 000	12 821 798,42
Animal production promotion	23 854 000	25 676 820,96
Agricultural resource utilisation	13 419 000	12 051 635,43
Entrepreneur development	6 491 000	7 405 861,65
Supporting and associated services	10 614 000	13 232 892,28
Thefts and losses		10 884,33
	77 437 000	82 280 542,62
Less: Internal Charges	1 868 000	3 761 130,72
	75 569 000	78 519 411,90
Less: Cash Discount		5 319,82
Salary Adjustments from Vote 31	2 945 092,08	
Total	78 514 092,08	78 514 092,08

(b) Revenue 1979/80

	R
Vaccine sales	2 233 256,24
Produce sales	1 369 031,97
Rent	153 111,51
Interest	18 457,51
Miscellaneous	2 780 735,40
Total	6 554 592,63

(4) BUILDINGS

MAJOR WORKS COMPLETED

	R
Irene	Animal and Dairy Science Research Institute: Energy and Metabolism Building 61 000
Middelburg (C.P.)	Grootfontein College of Agriculture: Administrative/Research Building, Abattoir and Extension to Agronomy Building 880 000
Onderstepoort	Building for Foot and Mouth Research 5 700 000
Pretoria	Soil and Irrigation Research Institute: Additions 1 049 100

Stellenbosch	Plant Protection Research Institute: Quarantine Station Additional Offices and Laboratories 950 000
Vryheid	Offices for State Veterinarian 264 000

MAJOR WORKS UNDER CONSTRUCTION

Pretoria	Agricultural Building Computer Processing Computer Centre 5 700 000
Pietermaritzburg	Cedara College of Agriculture: Regional Headquarters, Lecture Rooms and Alterations to existing Administrative Building 3 000 000
Stellenbosch	Elsenburg College of Agriculture: Administrative/Research Building 4 600 000
Dohne	Abattoir, Workshops and Garages 531 000
Dohne	Agricultural Research Station: Animal Husbandry/Research Building 814 000
Bloemfontein	Offices for State Veterinarian 686 100

(5) NEW LEGISLATION

Fertilizers, Farm Feeds, Agricultural Remedies and
Stock Remedies Amendment Act, No. 4 of 1980

Plant Breeders' Rights Amendment Act, No. 5 of
1980

Wine, Other Fermented Beverages and Spirits Act,
No. 7 of 1980

Fencing Amendment Act, No. 9 of 1980

